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Research Article

Predictors of Early Outcome in Pediatric Patients with Intestinal Obstruction at Bugando Medical Centre Mwanza, Tanzania

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Abstract

Background: Intestinal obstruction occurs when there is impedance to the flow of intestinal contents due to a congenital or acquired pathology which also can be functional or mechanical. It is a common and serious pediatric abdominal surgical emergency with high mortality and morbidity in Africa and Tanzania in particular.

This study aimed in determining the predictors of early outcomes among children with intestinal obstruction at Bugando Medical Centre.

Methodology: This was a hospital based Cross-sectional study involved pediatric patients diagnosed with intestinal obstruction at Bugando Medical Centre conducted for 5 months, from February 2023 to June 2023 where participants recruited following diagnosis of intestinal obstruction and assessed for the early outcomes within 14 days of their managements. A data collection tool was used to record important information on the child's socio-demographic data, history, physical examination and management details during the course of management. Blood samples were drawn for measurements of serum potassium, sodium, chloride, creatinine, urea using the chemistry analyzer Cobas Integra 400 plus and hemoglobin concentration using Dymind Hematology Analyzer. Statistical data analysis was performed using STATA version 15 and the p-value of <0.05 was used as a statistical level of significance.

Results: A total of 120 children admitted at Bugando Medical Centre with intestinal obstruction were enrolled. Majority were male 73 (60.8%). The median age was 6.5 [0-132] months and most of them were neonates 43 (35.8%) followed by infants 32 (26.7%), toddler 1-5years 31 (25.8%) and above 5 years 14 (11.7%). 61 (50.8%) had abdominal pain, vomiting occurred in 82 (68.3%), 92 (76.7%) had constipation, 8 (6.7%) had bloody stool/diarrhea, 48 (40%) had history of fever, abdominal distension was in 119 (99.2%) patients, change in bowel sound found in 42 (35.3%) patients and 26 (21.7%) patients had hyper/hypothermia on screening.

The most common etiology of obstruction was anorectal malformations 23 (19.2%) followed by Hirschsprung's disease 20 (16.7%), obstructed hernias 17 (14.2%), stoma stenosis 15 (12.5%), Intestinal atresia 13 (10.8%), Intussusceptions and the least were Intra-abdominal tumor 3 (2.5%) and congenital band 3 (2.5%). Early postoperative complications occurred in 23 (19.2%) participants, surgical site infection was a leading complication. High degree of contamination of surgery and fever on admission were the predictors of early postoperative complications. Prolonged hospital stay observed in 17 (14.2%) where malnutrition, comorbidity association, degree of contamination of surgery and early postoperative complication were the predictors. Mortality observed in 16 (13.3%) of all patients where, low birth weight, fever on admission and renal insufficiency were the predictors of mortality.

Conclusion: Intestinal obstruction remains to be a serious and most common pediatric abdominal surgical emergency in our setting with considerably high morbidity and mortality on their management which were associated with low birth weight, fever on admission, malnutrition, associated comorbidity, degree of contamination of surgery, renal insufficiency and early postoperative complications. Continuous/ongoing training to health care providers should be enhanced for timely diagnosis, preoperative care, safe surgical intervention and management of associated comorbidities and early complications in order to decrease the morbidity and mortality associated with this disease in pediatric.

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Abbreviations

BMC: Bugando Medical Centre; CDC: Centre of Disease Control; CREC: CUHAS/ BMC Research and Ethics Committee; CUHAS: Catholic University of Health and Allied Science; HD: Hirschsprung's Disease; IO: Intestinal Obstruction; JIA: Jujeno-Ileal Atresia; NICU: Neonatal Intensive Care Unit; PI: Principal Investigator; PICU: Pediatric Intensive Care Unit

Introduction

Intestinal obstruction occurs when there is impedance to the flow of intestinal contents due to a congenital or acquired pathology which

also can be functional or mechanical [1,2]. In pediatric population it is one of the important and serious conditions requiring emergency or urgent intervention, it is also reported to be the common pediatric surgical emergency condition worldwide and Tanzania in particular [3-10]. The incidence of intestinal obstruction is 1 in 2000 live births in new-born and 1 in 5000 in children greater than 2 years of age [11]. It is a potentially life-threatening condition, undiagnosed or improperly managed can progress to vascular compromise which causes bowel necrosis, perforation, sepsis in turn resulting to significant mortality and morbidity [12,13].

Children commonly present with abdominal and Gastrointestinal (GI) symptoms whereby in most cases are due to self-limited process such as viral gastroenteritis but this could be life-threatening surgical conditions. Due to these so common and nonspecific presentations, the recognition of surgical emergencies is frequently delayed or missed [5]. Pediatric intestinal obstruction differs from adult intestinal obstruction in terms of etiology, presentation, management and outcome [14,15], in this population group due to differences in diet, demography, socioeconomic or geographical factors in different settings etiologies and management outcomes are different [16-18].

In the developed countries, the prognosis is improved by rapid diagnosis and quality of perioperative care [19]. Delay in admission or management, hard access to hospital, lack of neonatal and pediatric intensive care and limited resources have been reported to be responsible for the poor prognosis of children with intestinal obstruction in Sub-Saharan Africa and other developing countries [8,20,21].

Country wise, pediatric intestinal obstruction reported to be the leading cause of pediatric abdominal surgical emergences in some studies [3], few specific etiologies of pediatric intestinal obstruction and their management outcomes have been studied [22-25] leaving a scarce of data on clinical patterns and predictors of early outcomes in pediatric patients with intestinal obstruction in general. The aim of this study was to determine the predictors of early management outcome in children with intestinal obstruction at Bugando Medical Centre, Mwanza, Tanzania.

Methodology

This was a hospital-based cross-sectional study conducted in Emergency department, Pediatric general surgery ward, Neonatal ward, Neonatal Intensive Care Unit and pediatric Intensive Care Unit and was carried out within a period of 5 months from February 2023 to June 2023 at BMC, Mwanza, Tanzania.

Results

Study enrolment

A total of 134 patients with intestinal obstruction were admitted at BMC Pediatric general surgical ward, Neonatal Intensive Care unit, Neonatal ward, Pediatric Intensive care unit and Pediatric medical ward from February 2023 to June 2023 and were screened for eligibility. 14 children left out of the study due to their conservative treatment modality and 120 patients analyzed.

Majority were male 73 (60.8%) with M:F=1.5:1. The patients' median age was 6.5 [0 - 132] months and most of them were neonates 43 (35.8%) followed by infants 32 (26.7%), toddler 1-5years 31 (25.8%) and above 5 years 14 (11.7%). 66 (55%) were from rural residence and 85 (70.8%) participants had no health insurance coverage (Table 1).

Table 1: Socio-demographic characteristics of patients with intestinal obstruction at Bugndo Medical Centre.

Variable	Frequency(n)	Percentage (%)
Age categories		
Neonate	43	36
Infants	32	27
Toddler (1-5 years)	31	26
Above 5 to 18 years	14	12
Gender		
Male	73	61
Female	47	39
Residence		
Rural	66	55
Urban	54	45
Health Insurance		
Yes	35	29
No	85	71

Clinical characteristics of patients with intestinal obstruction at BMC5

Referrals from hospital or clinic were 97 (80.8%) patients, among those 34 (35.1%) children didn't receive pre referral resuscitation care. The mean of illness duration to admission is 6.7 days with standard deviation of 4.18. 61 (50.8%) had abdominal pain, vomiting occurred in 82 (68.3%), 92 (76.7%) had constipation, 8 (6.7%) had bloody stool/diarrhea, 48 (40%) had history of fever, abdominal distension was in 119 (99.2%) participants, change in bowel sound found in 42 (35.3%) patients and 26 (21.7%) patients had hyper/hypothermia on screening. 20 (16.7%) patients had associated comorbidity and malnutrition found in 17 (14.2%) children. Anemia found in 52 (43.3%) patients, 73 (60.8%) had electrolyte imbalance, 16 (13.3%) had renal insufficiency (Table 2).

Management detail of patients with intestinal obstruction at Bugando Medical Centre

The median duration of diagnosis to surgical intervention is 12 (2-72) hours with 71 (59.2%) patients being operated within 24 hours after diagnosis. 11 (9.2%) patients had gangrenous bowel segment intraoperative, resection of bowel while relieving obstruction done to 87 (72.5%) patients and most common performed procedure was resection and stoma formation 51 (42.5%) followed by resection and anastomosis 25 (20.8%), hernia repair 14 (11.7%), adhesiolysis/band release 8 (6.7%), irrigation and biopsy taking 8 (6.7%), resection, anastomosis and stoma formation 6 (5%), resection without anastomosis 5 (4.2%) and milking 3 (2.5%).

The median duration of anesthesia and surgery was 85 [30-200] minutes with 37 (30.8%) participant's surgery lasted for at least 120 minutes. The most common etiology of obstruction was anorectal malformations 23 (19.2%) followed by Hirschsprung's disease 20 (16.7%), obstructed hernias 17 (14.2%), stoma stenosis/prolapse 15 (12.5%), Intestinal atresia 13 (10.8%), Intussusceptions 7 (5.8%) and others (Table 3, Figures 1 and 2).

Predictors of early postoperative complications of patients

Early postoperative complications occurred in 23 (19.2%) patients, surgical site infection was a leading complication with 20 (87%) patients, wound dehiscence/burst abdomen were 2 (8.7%) and fecal fistula 1 (4.3%). After adjusting factors in multivariate analysis high degree of contamination of surgery, (OR: 7.0; 95% CI: 1.6 - 29.7 p-value=0.008) and fever on admission, (OR: 49.2; 95% CI: 4.5 - 539.0; p-value=0.001) remained as independent factors associated with early postoperative complications (Figure 3, Table 4).

Table 2: Clinical characteristics of children with intestinal obstruction at Bugando Medical Centre.

Characteristics	Number (n)	Frequency (%)
Referral from hosp/clinic		
Yes	97	80.8
No	23	19.2
Pre-referral resuscitation		
Yes	63	52.5
No	57	47.5
Late presentation		
Yes	100	83.3
No	20	16.7
Abdominal pain/discomfort		
Yes	61	50.8
No	59	49.2
Vomiting		
Yes	82	68.3
No	38	31.7
Failure to pass stool		
Yes	92	76.7
No	28	23.3
Bloody stool/diarrhea		
Yes	8	6.7
No	112	93.3
Fever on admission		
Yes	72	60
No	48	40
Abdominal distension		
Yes	119	99.2
No	1	0.8
Change in bowel status		
Yes	43	35.8
No	77	64.2
Hypo/Hyperthermia		
Yes	26	21.7
No	94	78.3
Nutrition status		
Normal nutrition	103	85.3
Malnutrition	17	14.7
Associated comorbidity		
Yes	20	16.7
No	100	83.3

Table 3: Management detail of children with intestinal obstruction at Bugando Medical Centre.

Variable	Frequency(n)	Percentage (%)
Degree of contamination		
Clean	26	21.7
Clean contaminated	64	53.3
Contaminated	18	15
Dirty	12	10
Diagnosis to surgery duration		
< 24 Hours	71	59.2
<24Hours	49	40.8
Gangrenous bowel segment		
Yes	11	9.2
No	109	90.8
Obstruction relieve process		
With bowel resection	87	72.5
Without bowel resection	33	27.5
Anesthesia and surgery duration		
<120 minutes	83	69.2
>120 minutes	37	30.8

Predictors of prolonged hospital stay in patients with intestinal obstruction at BMC

Prolonged hospital stay observed in 17 (14.2%) patients. Malnutrition (OR:9.8;95%CI:1.6-58.0; p-value=0.012), comorbidity

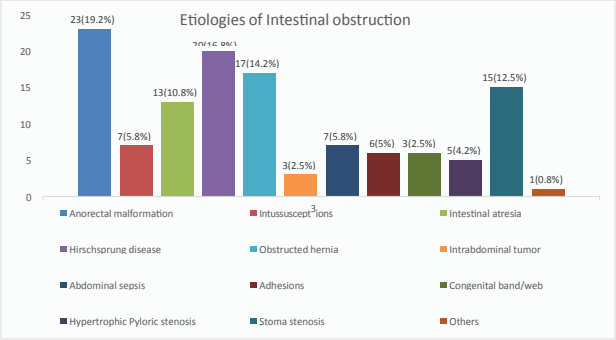

Figure 1: Etiologies of intestinal obstruction.

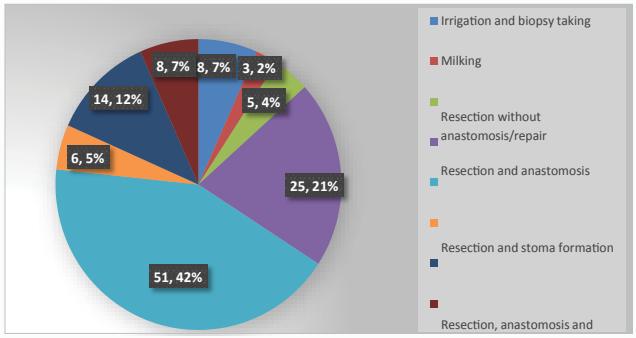

Figure 2: Predictors of early postoperative complications of patients.

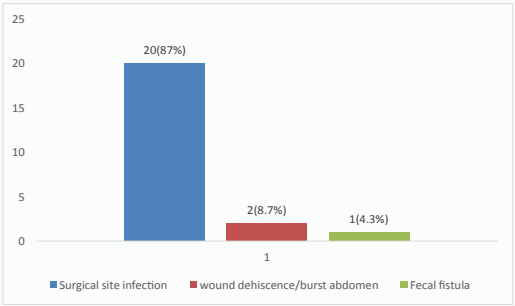

Figure 3: Early postoperative complications in participants with intestinal obstruction.

association (0R:20.1;95%CI:2.9-137.0;p-value 0.002), high degree of contamination of surgery (OR:7.2;95%CI:1.3-37.7:p-value=0.019) and early postoperative complications (OR:8.8;95%CI:1.4-56.0:p-value=0.020) had significant association with prolonged hospital stay on multivariate analysis.

Predictors of mortality in patients with intestinal obstruction at BMC

Mortality observed in 16(13.3%) of all patients. Low birth weight (OR:90.1;95%CI:5.6-1447.3:p-value=0.001), fever on admission (OR:15.7;95%CI:1.0-241.1:p-value=0.048) and renal insufficiency (OR:10.2;95%CI:1.1-93.8:p-value=0.040) had significant association to mortality on multivariate analysis.

Discussion

Intestinal obstruction is the most common pediatric surgical emergency in our setting [3,26], this study has evaluated 120 children managed with intestinal obstruction at BMC. This study has

Table 4: Predictors of early postoperative complications in 120 participants with intestinal obstruction at Bugando Medical Centre.

Variable	Early postoperative complication		Univariate		Multivariate	
	Yes (n)%	No(n)%	OR[95%CI]	P-Value	AOR[95%CI]	P-Value
Prematurity						
Yes	3(75%)	1(25%)	14.4[1.4-145.6]	0.024	5.1[0.1-1197.7	0.376
No	20(17.3%)	96(82.7%)	1			
Low birth weight						
Yes	6(50%)	6(50%)	5.3[1.5-18.5	0.008	3.4[0.2-47.1]	0.346
No	17(15.7%)	91(84.3%)	1			
Insurance						
Yes	3(8.5%)	32(91.5%)	1			
No	20(23.5%)	65(76.5%)	3.2[0.9-11.8]	0.07	0.3[0.0-2.7]	0.317
Late presentation						
Yes	19(82.6%)	81(83.5%)	0.9[0.28-3.12]	0.917		
No	4(17.4%)	16(16.5%)				
Fever on admission						
Yes	22(44.9%)	27(55.1%)	57.0[7.3-444.2]	<0.001	49.2[4.5-539.0	0.001
No	1(1.4%)	70(98.6%)	1			
Electrolyte imbalance						
Yes	18(24.6%)	55(75.4%)	2.7[0.9-8.0]	0.064	1.6[0.3-8.3]	0.524
No	5(10.6%)	42(89.4%)	1			
Comorbidity association						
Yes	6(30%)	14(70%)	2.0[0.7-6.2	0.184	0.7[0.1-3.5]	0.749
No	17(17%)	83(83%)	1			
Degree of contamination						
Low	10(11.1%)	80(88.9%)	1			
High	13(43.3%)	17(56.7%)	6.1[2.3-16.2]	<0.001	7.0[1.6-29.7]	0.008
Gangrenous bowel segment						
Yes	6(54.5%)	5(45.5%)	6.4[1.7-23.7]	0.005	2.4[0.3-19.3	0.395
No	17(15.6%)	92(84.4%)	1			
Resection of bowel						
Yes	20(22.9%)	67(77.1%)	2.9[0.8-10.8]	0.096	2.8[0.4-14.2]	0.276
No	3(9.1%)	30(90.9%)	1			
Blood loss >20% blood volume						
Yes	6(37.5%)	10(62.5%)	3.0[0.9-9.5]	0.053	0.5[0.0-3.7	0.503
No	17(16.4%)	87(83.6%)	1			
Malnutrition						
No	21(20.4%)	82(79.6%)	1			
Yes	2(11.7%)	15(88.3%)	0.5[0.1-2.4]	0.41		
Anemia						
Yes	9(17.3%)	43(82.4%)	0.8[0.3-2.0]	0.651		
No	14(20.6%)	54(79.4%)	1			
Renal insufficiency						
Yes	4(25%)	12(75%)	1.4[0.4-5.1]	0.526		
No	19(18.3%)	85(81.7%)				
Diagnosis to surgery duration						
<24 hours	13(18.3%)		1			
>24hours	10(20.4%)	39(79.6%)	1.1[0.4-2.8]	0.774		
Anesthesia and surgery duration						
<120 minutes	14(16.4%)	69(83.2%)	1			
>120 minutes	9(24.3%)	28(75.7%)	1.5[0.6-4.0]	0.34		

documented clinical characteristics and predictors of early outcome that have similarities and differences from same study done on different settings globally. Study found male predominance with majority of participants were below 1 year of age as seen on most studies globally and in Africa except in two studies in India where there was equal male and female distribution [18,27]. There are slight differences on intestinal obstruction clinical presentations proportions as reported in other studies [15,28] and this could be due to difference in health seeking behavior, sample size and age composition, referral system and etiological pathophysiology. Etiologies of intestinal obstruction in children varies with age and setting, the study found most common cause of intestinal obstruction in neonate being anorectal malformation followed by intestinal atresia which was similar to other studies [14,29], however other studies have reported malrotation as a leading cause of obstruction followed by intestinal atresia in neonate group [28,30]. In older group, infants and toddler below 5 years of age study found the most common cause being Hirschsprung's disease followed by obstructed hernia, stoma stenosis and intussusception, same findings on leading cause of intestinal obstruction on particular group found in Rwanda [31] similarity. But other studies have found intussusception being the leading cause of intestinal obstruction in this age group [16,17,20,32,33]. In above 5 to 18 years group of age most common cause was abdominal sepsis. In this study few cases of intussusceptions were observed unlike to other studies and stoma stenosis observed as one of the causes of obstruction which has not been explained in other studies. Difference in etiological proportions could be contributed by difference in sample size and age composition from different settings.

Early postoperative complication of 23 (19.2%) observed with surgical site infection being the most common complication. With same most common complication being surgical site infection these studies in Pakistan, Ghana and two in Kenya showed lower complication rate [12,13,15,33]. Other studies showed higher complication rate [16,17,29-31]. Difference in sample size, age composition and level of setting/hospital which impact on quality of services and severity of cases handled could be the reasons of these variations. In comparison to previous study done on this setting on intussusception and Hirschsprung's disease as ones among the causes of pediatric intestinal obstruction, complication rate was higher [22,23] compared to this study, this can explained by

currently presence of trained care providers on pediatric surgical care (Pediatric general surgeons and trained medical officers and nurses). Fever on admission and high degree of contamination of surgery was independently associated with early postoperative complications. A study in India showed similar finding of sepsis/fever on admission as a predictor of postoperative complication [28]. Lower age, anemia, gangrenous segment intraoperative, bowel resection was not associated with postoperative complication in contrary to findings from other studies [11,31] (Figure 4 and Table 5). Seventeen (14.2%) patients stayed at hospital for more than 14 days, unlike other studies done, this study has termed those who stayed for over 14 days as prolonged hospital stay as per disease pathophysiology, other studies have explained mean or median of duration of hospital stay. Comorbidity association, malnutrition, degree of contamination and early postoperative complications were independently associated with prolonged hospital stay. Similar findings found on these studies which also added bowel resection as a predictor too which also could tally with degree of contamination of surgery [22,23] (Figure 5 and Table 6).

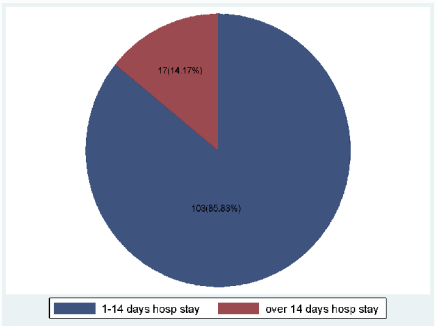

Figure 4: Mortality in patients with intestinal obstruction at BMC.

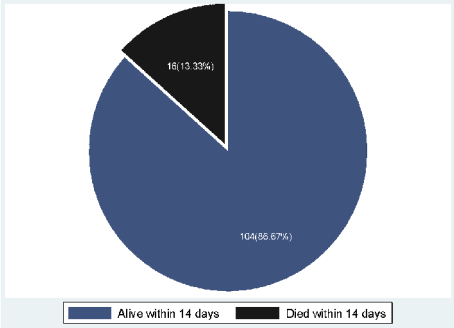

Figure 5: Mortality in 120 children with gastrointestinal obstruction at Bugando Medical Centre.

Sixteen (13.3%) patients died within 14 days of treatment, different studies have shown similar, lower and higher mortality rate on their settings. Lower mortality rate compare to this has been reported on studies done in Pakistan, Kenya, Ghana, Nigeria and Rwanda [12,13,15,20,31]. Also, this mortality is lower if compared to findings obtained in studies done in Niger, Egypt, Malawi, Uganda and Burundi [16,29,30,34,35]. Sample size, age composition and level of setting/ hospital level could be the reasons of these variations in mortality rate. Low birth weight, fever on admission and renal insufficiency were found to be associated with mortality. These were similar findings found in other studies in Egypt, Uganda and India where despite these similarities there were other factors like prematurity, low age(neonates), electrolyte imbalance, late presentation, early complications, bowel resection and low cadre of health care providers which found to have association on their studies but had no association in this study [11,20,28,30]. Difference in sample size and age composition, health seeking behavior, health facility level could be the reasons of these differences in etiological pattern, clinical presentations and management outcomes in different settings.

Conclusion

With different etiological patterns, clinical presentations and surgical management outcomes, intestinal obstruction remains to be a serious and most common pediatric abdominal surgical emergency in our setting with considerably high morbidity and mortality on their management which were associated with low birth weight, fever on admission, malnutrition, associated comorbidity, degree of contamination of surgery, renal insufficiency and early postoperative complications.

Ethical Consideration

Ethical clearance sought from the Joint CUHAS/ BMC research, ethic and review committee (CREC) before the commencement of the study. Permission to conduct the study obtained from BMC authority. Enrolled participant's parent or guardians were required to sign a written informed consent/assent.

All study findings were fully explained to the parent/guardian. Patients with abnormal findings were managed as per BMC patient protocol.

Acknowledgement

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Table 5: Predictors of prolonged hospital stay in 120 patients with intestinal obstruction at Bugando Medical Centre.

Variable	Prolonged Hospital stay		Univariate		Multivariate	
	Yes (n)%	No(n)%	OR[95%CI]	P-Value	AOR[95%CI]	P-Value
Prematurity						
Yes	1(25%)	3(75%)	2.0[0.2-21.2]	0.536		
No	16(13.8%)	100(86.2%)	1			
Low birth weight						
Yes	1(8.3%)	11(91.7%)	0.5[0.1-4.3]	0.548		
No	16(14.8%)	92(85.2%)	1			
Insurance						
Yes	1(2.9%)	34(97.1%)	1			
No	16(18.8%)	69(81.2%)	7.8[1.0-61.9]	0.05	10.9[0.6-182.9]	0.097
Late presentation						
Yes	16(94.1%)	84(81.6%)	3.6[0.5-28.8]	0.226	3.3[0.2-43.2]	0.359
No	1(5.9%)	19(18.4%)	1			
Fever on admission						
Yes	12(24.5%)	37(75.5%)	4.2[1.3-13.1]	0.011	0.2[0.0-2.2]	0.213
No	5(7%)	66(93%)	1			
Electrolyte imbalance						
Yes	12(16.4%)	61(83.6%)	1.6[0.5-5.0]	0.377		
No	5(10.6%)	42(89.4%)	1			
Comorbidity association						
Yes	8(40%)	13(60%)	6.7[2.1-20.7]	0.001	15.8[2.2-111.7]	0.006
No	9(9%)	91(91%)	1			
Degree of contamination						
Low	7(7.8%)	83(92.2%)	1			
High	10(33.3%)	20(66.7%)	5.9[2.0-17.4]	0.001	6.6[1.3-35.2]	0.025
Gangrenous bowel segment						
Yes	4(36.4%)	7(63.4%)	4.2[1.0-16.4]	0.038	5.6[0.9-35.4]	0.067
No	13(11.9%	96(88.1%)	1			
Resection of bowel						
Yes	13(14.9%)	74(85.1%)	1.2[0.3-4.2]	0.693		
No	4(12.1%)	29(87.9%)	1			
Blood loss >20% blood volume						
Yes	6(36.5%)	10(62.5%)	5.0[1.5-16.6]	0.007	1.6[0.2-10.4]	0.574
No	11(10.6%)	93(89.4%)	1			
Malnutrition						
No	11(10.7%)	92(89.3%)	1			
Yes	6(35.3%)	11(64.7%)	4.5[1.4-14.7]	0.011	10.6[1.7-64.2]	0.01
Anemia						
Yes	8(15.4%)	44(84.6%)	1.1[0.4-3.3]	0.738		
No	9(13.2%)	59(86.8%)	1			
Renal insufficiency						
Yes	1(6.3%)	15(93.7%)	0.3[0.0-2.9]	0.347		
No	16(15.4%)	88(84.6%)	1			
Diagnosis to surgery duration						
<24 hours	9(12.7%)	62(87.3%)	1			
>24hours	8(16.3%)	41(83.7%)	1.3[0.4-3.7]	0.574		
Anesthesia and surgery duration						
<120 minutes	9(10.8%)	74(89.2%)	1			
>120 minutes	8(21.6%)	29(78.4%)	2.2[0.7-6.4]	0.124	3.3[0.6-19.3]	0.174
Early Postoperative complications						
Yes	9(39.1%)	14(60.9%)	7.1[2.3-21.6]	<0.001	8.4[1.3-54.5]	0.025
No	8(8.3%)	89(91.7%)	1			

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Table 6: Predictors of mortality in 120 patients with intestinal obstruction at Bugando Medical Centre.

Variable	Mortality		Univariate		Multivariate	
	Yes (n)%	No(n)%	OR[95%CI]	P-Value	AOR[95%CI]	P-Value
Prematurity						
Yes	4(100%)	0(0%)				
No	12(10.3%)	104(89.7%)				
Low birth weight						
Yes	8(66.7%)	3(33.3%)	25[6.1-101.3]	<0.001	90.1[5.6-1447.3]	0.001
No	8(7.4%)	100(92.6%)	1			
Insurance						
Yes	0(0%)	35(100%)	1			
No	16(18.8%)	69(81.2%)				
Late presentation						
Yes	13(81.2%)	87(83.6%)	0.8[0.2-3.2]	0.81		
No	3(18.8%)	17(16.4%)	1			
Fever on admission						
Yes	15(30.6%)	34(69.4%)	30.8[3.9-243.5]	0.001	15.7[1.0-247.1]	0.048
No	1(1.4%)	70(98.6%)	1			
Electrolyte imbalance						
Yes	14(19.2%)	59(80.9%)	5.3[1.1-24.6]	0.032	3.9[0.4-33.9]	0.212
No	2(4.3%)	45(95.7%)	1			
Comorbidity association						
Yes	6(30%)	14(70%)	3.3[1.2-12.2]	0.022	1.1[0.1-8.2]	0.9
No	90(90%)	10(10%)	1			
Degree of contamination						
Low	9(10%)	81(90%)	1			
High	7(23.3%)	23(76.7%)	2.7[0.9-8.1]	0.07	3.3[0.4-23.6]	0.222
Gangrenous bowel segment						
Yes	2(18.1%)	9(81.9%)	1.5[0.2-7.7]	0.622		
No	14(12.8%)	95(87.2%)	1			
Resection of bowel						
Yes	14(16.1%)	73(83.9%)	2.9[0.6-13.8]	0.166	0.7[0.0-7.0]	0.772
No	2(6.1%)	31(93.9%)	1			
Blood loss >20% blood volume						
Yes	6(37.5%)	10(62.5%)	5.6[1.6-18.7]	0.005	0.8[0.0-7.6]	0.898
No	10(9.6%)	94(90.4%)	1			
Malnutrition						
No	15(14.6%)	88(85.4%)	1			
Yes	1(5.9%)	16(94.1%)	0.3[0.0-2.9]	0.347		
Anemia						
Yes	7(13.5%)	45(86.5%)	1.0[0.3-2.9]	0.971		
No	9(13.2%)	59(86.8%)	1			
Renal insufficiency						
Yes	6(37.5%)	10(62.5%)	5.6[1.6-18.7]	0.005	10.2[1.1-93.8]	0.04
No	10(9.6%)	94(90.4%)	1			
Diagnosis to surgery duration						
<24 hour	8(11.3%)	63(88.7%)	1			
>24hours	8(16.3%)	41(83.3%)	1.5[0.5-4.4]	0.425		
Anesthesia and surgery duration						
<120 minutes	10(12.1%)	73(87.9%)	1			
>120 minutes	6(16.2%)	31(83.8%)	1.4[0.4-4.2]	0.536		
Early Postoperative complications						
Yes	11(43.5%)	13(56.5%)	11.6[3.6-37.4]	<0.001	3.0[0.4-19.6]	0.239
No	6(6.2%)	91(93.8%)	1			

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