

Non-traumatic Abdominal Surgical Emergencies in Children

Shazim Harunani, Kennedy Imbaya, Tenge Kuremu

Moi University, Eldoret

Correspondence to: Dr. Harunani Shazim, PO Box 82647, Mombasa; email: dr_s.harunani@hotmail.com

Abstract

Background: In developing countries, non-traumatic childhood abdominal surgical emergencies (NTCASE) are associated with high morbidity and mortality and include acquired diseases like acute appendicitis, intussusception and congenital abdominal anomalies such as gastroschisis. This study sought to identify the etiologies and outcomes of NTCASE at Moi Teaching and Referral Hospital (MTRH), Kenya. **Methods:** A prospective descriptive study that involved children below 18 years operated on for non-traumatic abdominal surgical emergencies between January 2015 and January 2016. Relevant data on clinical presentation, duration of onset of symptoms, investigations and intraoperative findings were entered into the data collection sheet. Daily follow-up was done until discharge or in-hospital death, and outcomes recorded. **Results:** A total of 140 patients were studied. Age of the patients ranged from 1 day to 17 years, with a mean of 3.0 (SD±2.9) years. Children below 2 years constituted 72.9% of the study participants. The male to female ratio was 2.1:1. The

most common aetiologies were intussusception (17.9%) and gastroschisis (17.9%). The complication rate was 17.9% ($n=25$), average length of hospitalization 8.6 ± 7.6 days, and in-hospital mortality 20%. **Conclusion:** The commonest aetiologies of NTCASE in MTRH are intussusception and gastroschisis. Mortality and morbidity rates are high. Factors co-related with mortality in patients with NTCASE are deranged potassium level, ASA classification grade 3 and 4, neonates, normal haemoglobin level, duration of illness presentation <24 hours, and development of complications.

Keywords: Non-traumatic childhood abdominal surgical emergencies, Etiologies, Outcomes, Children
Ann Afr Surg. 2020; 17(1): 3–6.

DOI: <http://dx.doi.org/10.4314/aas.v17i1.2>

Conflicts of Interest: None

Funding: None

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Introduction

Non-traumatic childhood abdominal surgical emergencies (NTCASE) are common and their etiologies many. Some etiologies are acquired gastrointestinal diseases such as acute appendicitis, intussusception and perforation peritonitis, and congenital anomalies such as anorectal malformations and gastroschisis. In young children, aetiologies have been reported to have high mortality in developing countries (1). Among the leading causes of high morbidity and mortality in developing countries are delayed presentation and poverty (2). Electrolyte derangements occur more often in young children and may delay management. Other factors affecting mortality include ASA classification and haemoglobin level. Children constitute more than 40% of the population in most developing countries and therefore deserve a share of robust surgical care; thus, surgical services should be planned to reduce mortalities associated with these abdominal emergencies (2). Data on NTCASE is scarce at Moi Teaching and Referral

Hospital (MTRH) and in Kenya. This study will act as a backbone of comparing data from MTRH with other institutions. This study aims to elucidate the various etiologies and immediate postsurgical outcomes in children managed for non-traumatic abdominal surgical emergencies at the MTRH and the factors correlated with mortality.

Methodology

A prospective descriptive study of children aged below 18 years presenting with non-trauma related abdominal emergencies at MTRH (surgical wards and newborn unit) between January 2015 and January 2016. The sample size was determined using Fisher et al.'s statistical formula (3) :

$$n = Z^2pq / d^2$$

where n = desired sample size (when population is greater than 10,000), Z = the standard normal deviate set at 1.96 which corresponds to 95% confidence level, p = characteristic of the study population (10.1%

mortality rate from previous data), $q=1-p$ (in this case $q=1.0-0.101$), and d =the degree of accuracy desired, set at 5% or 0.05 corresponding to the 1.96. A sample size of 140 was calculated.

Inclusion criteria were children operated on for non-traumatic abdominal surgical emergencies at the MTRH and children with a consent and assent for those above 7 years. Exclusion criteria were patients who had been operated on elsewhere and then referred to MTRH and patients with obvious comorbidities.

The starting point for data collection was in the surgical wards and new born unit after patients were identified from the theatre register. Patients who met the inclusion criteria were consecutively enrolled in the study. Data collection was conducted by the investigators and entailed filling a questionnaire on clinical presentation, duration of onset of symptoms, investigations, supportive management and intraoperative findings as per case notes.

Outcome evaluation parameters included complications, hospital stay and death. Daily follow-up was done until discharge or in-hospital death, either of which was taken as the end point of the study. All filled questionnaires were checked for completeness, and coded accordingly. Data was entered into an Access database and exported to SPSS version 20.0 for analysis. Continuous data were analysed using means and standard deviation (SD). Categorical data were presented as frequency tables and charts. For binary data, Chi-square test and Fisher's exact test were used for analysis. A p value of <0.05 was considered significant.

Ethical statement

This study was approved by IREC, FAN 1277. Approval from the MTRH was also sought and granted.

Results

Patients' ages ranged from 1 day to 17 years, with a mean of 3.0 and SD of ± 2.9 years. Neonates comprised 67 (65.7%) out of the 102 children. The male to female ratio was 2.1:1. Table 1 shows the diverse aetiologies identified. The average length of hospitalization and SD was 8.6 ± 7.6 days, ranging from 1 day to 35 days. Overall in-hospital mortality was 20% (28 patients) with 24 being neonates (Table 2).

Outcome of NTCASE

The overall complication rate was 17.9% ($n=25$). Neonates constituted 19 of these 25 patients. Table 3 shows the specific complications identified.

Table 1. Etiology of NTCASE

Aetiology of NTCASE	Frequency (%)	Mean age of patients
Gastroschisis	25(17.9)	1.64 days
Intussusception	25(17.9)	1.57 years
Anorectal malformations	15(10.7)	4 days
Small bowel atresia	15(10.7)	9.8 days
Appendicular abscess	7(5.0)	10.57 years
Acute appendicitis	11(7.9)	9.36 years
Inguinal hernias	9(6.4)	2.16 years
Ileal perforations	5(3.6)	4.68 years
Others*	28 (19.9)	3.67 years

* umbilical hernia, omphalocele, pyloric stenosis, Hirschsprung's, necrotizing enterocolitis, ascariasis

Table 2. Case-specific mortality

Etiology of NTCASE	Case fatality frequency (%)
Gastroschisis	11(44)
ARM	5(33.3)
Small bowel atresia	5(33.3)
Ileal perforation	3(60)
Colon atresia	1(100)
NEC	1(50)
Intussusception	2(8)
Total	28(20)

Table 3. Complications identified

Complication	Frequency (%)
Septicemia	19(76)
Wound dehiscence	2(8)
Burst abdomen	1(4)
Electrolyte derangement	1(4)
Prolapsed stoma	1(4)
Enterocutaneous fistula	1(4)
Total	25(100)

Factors correlated with mortality

Development of complications, duration of illness (<24 hours), ASA classification (grade 3, 4), deranged potassium levels, normal hemoglobin level (>12 g/dL); neonates had significant correlation with mortality (Table 4).

Discussion

Congenital anomalies were more common; average age of children was low compared with studies from India, Nigeria and Ghana (4-6). The tertiary nature of services offered may explain the difference in etiology and mean age when compared with studies from other developing economic regions. Gastroschisis, a serious congenital

Table 4. Correlation between various variables and eventual outcome

Variable	Outcome		p value
	Alive (%)	Dead (%)	
<i>Presence of complications</i>			
No	99(86.1)	16 (13.9)	0.0001
Yes	13(52)	12 (48)	
<i>Sex</i>			
Male	78(82.1)	17 (17.9)	0.373
Female	34(75.6)	11(24.4)	
<i>Any antibiotic given</i>			
Yes	98(79.7)	25 (20.3)	0.794
No	14(82.4)	3 (17.6)	
<i>WBC</i>			
Normal	59(80.8)	14(19.2)	0.576
Abnormal	49(77.8)	14 (22.2)	
<i>Temperature at admission</i>			
Normal	79(70.5)	23 (29.5)	0.217
High	33(86.8)	5 (13.2)	
<i>Gut viability</i>			
Viable	102(80.3)	25 (19.7)	0.771
Gangrene	10(76.9)	3 (23.1)	
<i>ASA classification</i>			
1,2	100(85.5%)	17 (14.5)	0.0003
3,4	12(52.2)	11 (47.8)	
<i>Duration of illness</i>			
<24 hours	28(66.7)	14(33.3)	0.0098
>24 hours	84(85.7)	14(14.3)	
<i>Referral status</i>			
Referrals	71(77.2)	21(22.8)	0.247
Home	41(85.4)	7(14.6)	
<i>Potassium level</i>			
Normal	86(87.8)	12(12.2)	0.0005
Abnormal	26(61.9)	16(38.1)	
<i>Sodium level</i>			
Normal	85(80.2)	21(19.8)	0.921
Abnormal	27(79.4)	7(20.6)	
<i>Hemoglobin level</i>			
Normal	68(73.9)	24(26.1)	
Abnormal	44(91.7)	4(8.3)	
<i>Pulse rate</i>			
Normal	86(82.7)	18(17.3)	0.0127
Abnormal	26(72.2)	10(27.8)	0.176
<i>Age group</i>			
Neonates	43(64.2)	24(35.8)	0.0001
>1 month	69(94.5)	4(5.5)	

p value <0.05 was significant

Normal sodium levels are between 135 to 145 mEq/L

Normal potassium levels range between 3.5 and 5.5 mEq/L

anomaly that is on the rise worldwide, is a significant burden in this region. Intussusception has maintained its burden as one of the commonest abdominal surgical emergencies not only in this region but also in most parts of the world (5,7,8).

The complication rate was higher in this study than in other studies (2,9). Patients who developed complications stayed significantly longer in hospital. This long hospital stay could be because patients with surgical complications underwent another operation to solve the complication, or due to prolonged antibiotic therapy for some complications like septicaemia. Similar results have been reported by other authors (10). Also, patients with gastroschisis stayed longer in hospital due to having staged procedures in theatre at different times. The mortality rate in this study was also higher than in other studies (2,9). The highest mortality was in neonates, without any significant gender difference. Lack of adequate total parenteral nutrition and paediatric critical care facilities coupled with their low immunity and poor physiological body reserves in the face of serious congenital and acquired disorders could be responsible for the high mortality and morbidity in children (2,11). Most patients presented late (>24 hours). The effect of late presentation can be noted by the higher mortality rate compared with other studies. However, presentation of <24 hours had a statistically positive correlation with mortality. This might be due to the low number of patients presenting before 24 hours and the rush to operate on them without sufficient resuscitation, and also to poor monitoring of these patients with the assumption that their vital signs and electrolytes had been normal before surgery. Other factors affecting mortality were age <2 years, anemia, ASA classification grade 3 and 4, and deranged potassium levels.

Despite correction of the deranged potassium levels (both high and low) before surgery, these had a positive correlation with mortality (p<0.0005). Stabilizing electrolytes before taking patients to theatre is a basic regulation worldwide. Emphasis should be on early presentation of patient to avoid severe electrolyte derangements and aggressive resuscitation (2,5), and monitoring from admission till discharge. Neonates have intrinsic challenges like increased susceptibility to infections, hypocalcaemia, hypoglycemia and poor cardiovascular reserves related to the transition from fetal to post-natal life. Trauma of surgery distorts the delicate balance, making them susceptible to sepsis, dyselectrolytemias, anemia and nutritional deficits, and respiratory complications (2).

Conclusion

The most common aetiologies of NTCASE at MTRH are intussusception and gastroschisis. Mortality and morbidity rates are clinically high. Factors correlated with mortality in patients with NTCASE are deranged potassium levels, ASA classification grade 3 and 4, neonates, normal hemoglobin level, duration of illness, presentation <24 hours, and development of complications. Increased morbidity and mortality in children with non-traumatic abdominal surgical emergencies at MTRH can be reduced by considering the factors associated with them.

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