

## Original Research Article

## Clinical Pattern and Predictors of Early Outcome of Paediatric Surgical Abdominal Emergencies at Bugando Medical Centre-Mwanza Tanzania

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### Article History

Received: 02.01.2022

Accepted: 07.02.2022

Published: 11.02.2022

### Journal homepage:

<https://www.easpublisher.com>

### Quick Response Code



**Abstract: Background:** Pediatric surgical abdominal emergency is a serious condition with reported high mortality in Africa and Bugando Medical Centre in particular. This study aimed at understanding the clinical pattern and predictors of early outcome of pediatric surgical abdominal emergencies at Bugando Medical Centre. **Methods:** A longitudinal descriptive study involving 130 patients with PSAE at BMC from November 2020 to May 2021. Patients were fully investigated and operated as per standard guidelines. Structured questionnaire was used to collect data which were analysed using STATA version 13. A p-value of less than 0.05 was considered significant. **Result:** A Male: Female ratio of 1.7:1 was noted, the median age of patients was 3years majority presenting with abdominal distension (94.6%), abdominal pain (91.5%) and vomiting (76.2%). The leading cause of Paediatric surgical abdominal emergencies were intestinal obstruction (66.0%) and peritonitis (21.8%). Short hospital stay (61.5%) was the commonest outcome followed by prolonged hospital stay (38.5%), and death (19.6%). Adolescent age (p-value=0.022) and rural residence (p-value=0.042), were significantly associated with increased duration of hospital stay while hyponatremia (p-value= 0.001), hypokalaemia (p-value=0.001) and low haemoglobin level (p-value=0.05) were found to significantly predict mortality. **Conclusion:** Intestinal obstructions and peritonitis are the commonest cause of PSAE at BMC, often presenting with abdominal pain and distension. Majority of patients have a short hospital stay, but adolescence and rural residence are associated with increased length of hospital stay. Electrolyte imbalance is significantly associated with mortality which was found to be decreasing but remains high at BMC.

**Keywords:** Paediatric surgical abdominal emergency, laparotomy, peritonitis, intestinal obstruction, electrolyte imbalance.

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## INTRODUCTION

Paediatric surgical abdominal emergency (PSAE) is a clinical condition that demands an urgent attention and treatment. Such emergencies are a common reason for admission and surgery among children globally [1-3]. In sub-Saharan Africa, PSAE accounts for 6-12% of all emergences surgical conditions with an even higher prevalence in rural areas [13, 14].

The causes and pattern of PSAE appear to vary over time and change with geographical location but are generally grouped into congenital and acquired causes [4, 5]. This variation in pattern is further reflected in studies conducted across Africa in which, while in Enugu Hospital in Nigeria, Intussusception was the most common cause for PSAE followed by typhoid perforation (1), in Ghana, typhoid perforation was most

common cause of PSAE followed by acute appendicitis (21) while at a tertiary hospital in Ethiopia, acute appendicitis was the commonest cause of PSAE, followed by intestinal obstruction [10]. Little is known about the pattern of PSAE in East Africa.

Prolonged hospital stay, post-surgical complication and death are notable outcomes among PSAE patients [12, 21, 23]. High mortality in this age group has been seen as one of the immediate outcomes in studies done across Africa and has been attributed to both late presentation at health facility, delays in receiving appropriate care and lack of skilled personnel among others [21, 23]. The Clinical Pattern and Predictors of early Outcome among Paediatric surgical abdominal emergencies remains undetermined at Bugando Medical Centre despite a previously reported high mortality in this age group.

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## METHODOLOGY

### Study Design and setting

A prospective descriptive study conducted from November 2020 to May 2021 at the emergency, gynaecology and surgical department at Bugando Medical Centre.

### Study Participants

A total of 130 paediatric patients from 1 month up to 18 years presenting with paediatrics surgical abdominal emergencies at BMC during the study period were included in this study., excluding those who presented with surgical abdominal emergencies resulting from a known congenital condition. The sample size was calculated using Yamane Taro formula (26),

$$n = N/I + N * (e^2)$$

Where n was the estimated sample size; N was the number of patients with PSAE for 6 months (160); and e is the error margin (0.05).

## DATA COLLECTION

Convenience sampling technique was used to recruit study participants. Data was collected by using structured questionnaire after pre testing at Regional Referral Hospital. Tool evaluation was done to see adequate/ efficacy of the tool.

Parents/guardian of patients who met the inclusion criteria were offered explanations about the study and requested to consent before being enrolled into the study. The research assistant and the principal investigator gathered relevant information regarding history and physical examination.

After diagnosis blood samples were taken for analysis, surgery performed as per standard guidelines. Post-operative patients were admitted either into Adult Intensive Care Unit or High Dependent Unit. Patients were followed at 24hrs, 48hrs. and 72hrs post-surgery where Full blood Count and electrolytes were done and reviewed for discharge at day 7 and further at day 14 for any complications.

## DATA ANALYSIS

Data were entered into Epi info then to Micro excel and last exported to the STATA version 13.0 software for analysis. Categorical variables were presented as percentages /proportions, whereas continuous variables were described as mean ( $\pm$  standard deviation) or median (interquartile range)

depending on the distribution of data. Chi-square ( $\chi^2$ ) test and Fisher's exact test was used to test for the significance of association between the independent variable and mortality in the categorical variables. Odds ratio was calculated to test for strength of association between independent variables and length of hospital stay. Significance was defined as a p-value of less than 0.05. Variables with a p value < 0.20 in univariate analysis were analysed in a multivariate regression model.

## RESULTS

Socio-demographic characteristics of paediatric surgical abdominal emergency patients. A total of 130 patients were recruited into the study, their age ranged from 1 month – 18 years with the median age of 36 [IQR 8-120] months. Majority of the patients, 64 (49.2%) were infants followed by 37 (28.5%) who were children and 29 (22.3%) who were adolescents. Of all patients, 86 (66.2%) came from rural areas and most of the admission 105 (80.8%) were referred from other health facilities. {Table 1}

Table-1

Patient characteristic	Number (n)	Percent (%)
Age		
Infancy	64	49.2
Children	37	28.5
Adolescents	29	22.3
Sex		
Male	82	63.1
Female	48	36.9
Area of Residence		
Rural	86	66.2
Urban	44	33.8
Referral status		
Hospital	105	80.8
Self	25	19.2
Admitted ward		
General surgery	128	98.5
Gynaecology	2	1.5

**Clinical characteristic of the paediatric surgical abdominal emergency:** Most of patients presented with abdominal distension 123 (94.6%) and/or abdominal pain 119 (91.5%), followed by vomiting 99 (76.2%), constipation 70 (53.9%), fever 25 (19.2%) and bloody diarrhoea 25 (19.2%), with most patients presenting with more than one symptom. The most common signs at the time of presentation were diminished/exaggerated bowel sound 83 (63.9%), followed by rebound tenderness 47(36.2%) and muscle guarding 41(31.5%) {Table 2}

**Table-2: Clinical characteristic of paediatric surgical abdominal emergency**

Clinical characteristics	Number (n)	Percept (%)
<i>Clinical Presentation</i>		
<i>Symptoms</i>		
Abdominal distension	123	94.6
Abdominal pain	119	91.5
Vomiting	99	76.2
Constipation	70	53.9
Fever	25	19.2
Blood diarrheal	25	19.2
<i>Signs</i>		
Diminished bowel sound	83	63.9
Rebound tenderness	47	36.2
Muscle guarding	41	31.5

**Clinical characteristic of the paediatric surgical abdominal emergency by age.**

Abdominal distension was the most common reported symptom in all age groups, however abdominal pain was more reported by adolescents (100%) and children (97.3%). Diminished bowel sound

was the most detected clinical signs in infancy (82.2%) and children (54.1%), while rebound tenderness (69.0%) was the most common elicited sign in adolescent followed by muscle guarding (62.1%) {Table 3}

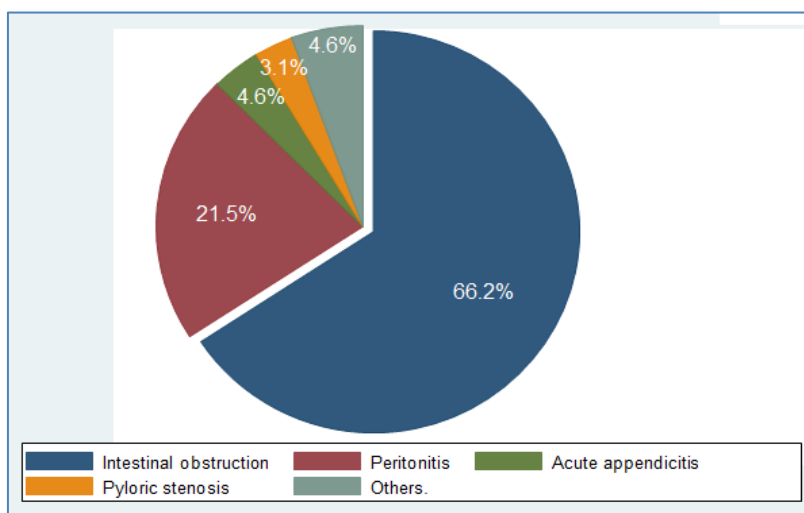
**Table-3: Proportion of clinical presentation of PSAES by age**

CLINICAL FEATURES	INFANCY	CHILDREN	ADOLESCENTS
	n (%)	n (%)	n (%)
<i>Symptoms</i>			
	N= 64	N= 37	N = 29
Abdominal distension	62(96.9)	33 (89.2)	28 (96.6)
Abdominal pain	54 (84.4)	36(97.3)	29 (100)
Vomiting	48 (75.0)	28 (75.7)	23 (79.3)
Constipation	43 (67.2)	17 (46.0)	10(34.5)
Fever	10 (15.6)	7 (18.9)	8 (27.6)
Blood diarrheal	23 (35.9)	1 (2.7)	1 (3.5)
<i>Signs</i>			
Diminished bowel sound	53 (82.8)	20 (54.1)	10 (34.5)
Rebound tenderness	11 (17.2)	16 (43.2)	20 (69.0)
Muscle guarding	11 (17.2)	12 (32.4)	18 (62.1)

**Clinical diagnosis of paediatric surgical abdominal emergency**

Among 130 enrolled patients, majority had intestinal obstruction 86 (66.2%) followed by peritonitis 28 (21.5%). Other diagnosis were acute appendicitis 6

(4.6%), pyloric stenosis 4 (3.1%), and others 6 (4.6%) [2 penetrating abdominal injuries, 1 enterocutaneous fistula, and 1 bleeding peptic ulcer, 1 short bowel injury and 1 stoma prolapse]. {Figure 1}



**Fig-1: Clinical diagnosis of paediatric surgical abdominal emergency**

**Clinical diagnosis of paediatric surgical abdominal emergency by age**

Intestinal obstruction was the most common clinical diagnosis in infancy (84.4%) and children (62.2%) but was less frequent in adolescents (31%),

while peritonitis was the most common clinical diagnosis in adolescents (58.6%) however was less common in children (13.5%). Other less common clinical diagnoses are as indicated {**Table 4**}.

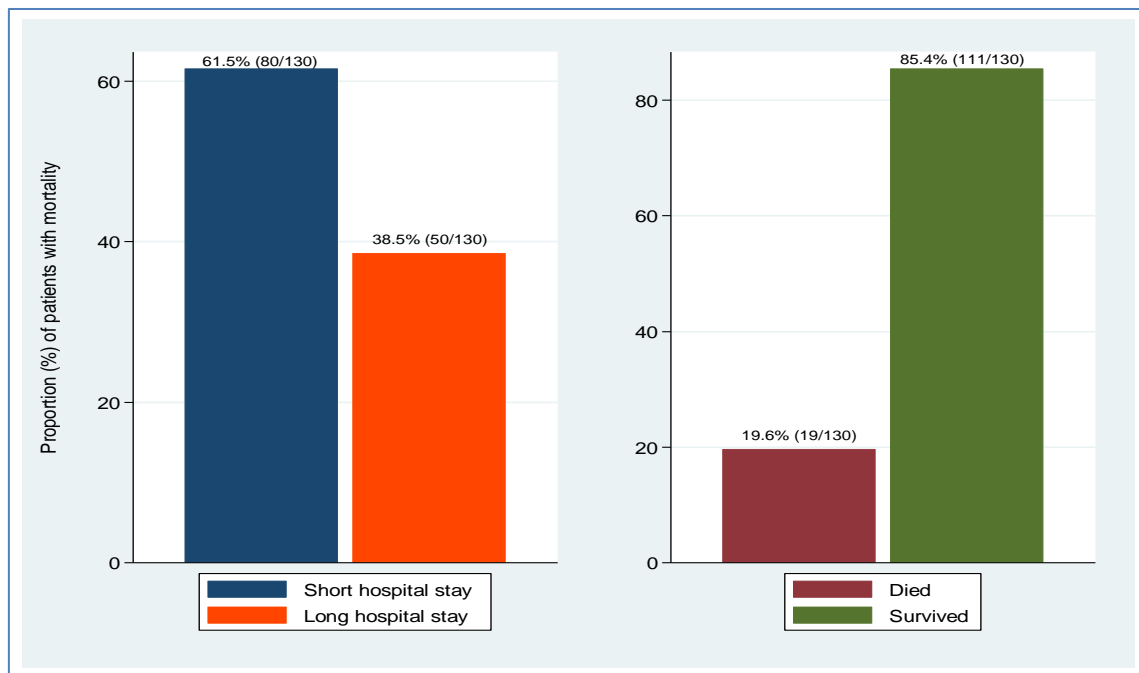
**Table-4: Frequency distribution of clinical diagnosis by age of paediatric surgical abdominal emergency**

Diagnosis	Infancy n (%)	Children n (%)	Adolescents n (%)	Total
Intestinal obstruction	54(84.4%)	23(62.2%)	9(31%)	86(66.2%)
Peritonitis	6(9.4%)	5(13.5%)	17(58.6%)	28(21.5%)
Acute appendicitis	0	6(16.2%)	0	6(4.6%)
Pyloric stenosis	4(6.2%)	0	0	4(3.1%)
Bleeding peptic ulcer	0	0	1(3.4%)	1(0.8%)
Enterocutaneous fistula	0	0	1(3.4%)	1(0.8%)
Penetrating abdominal injury	0	2(5.4%)	0	2(1.5%)
Short bowel syndrome	0	1(2.7%)	0	1(0.8%)
Stoma prolapse	0	1(2.7%)	0	1(0.8%)
Total	64	38	28	130

**Early outcome of paediatric surgical abdominal emergencies**

Of the 130 paediatric surgical abdominal emergency, short hospital stay (61.5%) was the

commonest early outcome, followed by prolonged hospital stay(38.5%), while death occurred in (19.6%) of operated PSAE after a short hospital stay {**Figure 2**}.



**Fig-2: Distribution of early outcome of paediatric surgical abdominal emergencies**

**Predictors of length of hospital stay among Paediatric patients with surgical abdominal emergencies admitted at Bugando Medical Centre**

On univariate logistic regression analysis, adolescents (OR 3.4; 95% CI [1.3 – 8.4]; p-value =0.009), low haemoglobin level (OR= 2.2, 95% CI [1.1-4.5], p-value=0.032), Duration of surgery (OR= 1.0, 95% CI [1.0-1.0], p-value=0.038), Surgical site

infection (OR=4.8,95% CI [1.7-13.5], p-value=0.003), were found significant for long hospital stay.

However, on multivariate logistic regression analysis, age (OR=4.5; 95% CI [1.2 – 20.4]; p-value=0.022), area of residence (OR =3.4; 95% CI [1.2 – 9.5]; p-value=0.042), remained significant to predict length of hospital stay {**Table 5**}.

**Table-5: Predictors of length hospital stay among Paediatric patients with surgical abdominal emergencies admitted at Bugando Medical Centre**

Patients' characteristic	LENGTH OF HOSPITAL STAY		UNIVARIATE		MULTIVARIATE	
	LONG	SHORT	OR[95% CF]	p- value	OR(95% CF)	p- value
<i>Age</i>	n (%)	n (%)				
Infancy	21 (38.8)	43 (67.2)				
Children	11 (29.7)	26 (70.3)	0.9 [ 0.4-2.1]	0.748	1.3 [0.4-4.2]	0.715
Adolescent	18 (62.1)	11 (37.9)	3.4 [1.3-8.4]	0.009	5.2 [1.3-21.1]	0.022
<i>Gender</i>						
Male	33 (40.2)	49 (59.8)				
Female	17 (35.4)	31 (64.6)	0.8 [0.4-1.7]	0.585	-	-
<i>Residents</i>						
Urban	12 (27.3)	32 (72.7)				
Rural	38 (44.2)	48 (55.8)	2.1 [1.0-4.6]	0.063	0.4 [0.1-1.0]	0.042
<i>Education</i>						
Informal	23 (37.7)	38 (62.3)				
Primary	23 (47.9)	25 (52.1)	1.5 [0.7-3.3]	0.285	1.9[0.7-4.9]	0.216
Secondary	4 (19.1)	17 (81.0)	0.4 [0.1-1.3]	0.125	0.4 [0.1-2.3]	0.319
<i>Duration of presentation</i>						
<72hrs	18 (31.0)	40 (69.0)				
> 72hrs	32 (44.4)	40 (55.7)	1.8 [0.7-3.7]	0.120	1.3[0.5-3.4]	0.595
<i>Insurance</i>						
Insured	6 (24.0)	19 (76.0)				
No insured	44 (41.9)	61 (58.1)	2.3 [0.8-6.2]	0.104	1.1[0.3-4.1]	0.940
<i>Surgeon</i>						
Resister	3 (60.0)	2 (40.0)				
Resident	32 (49.2)	33 (50.8)	0.7 [0.1-4.2]	0.645	0.5[0.1-3.8]	0.497
Specialist	12 (29.3)	29 (70.7)	0.3 [0.1-1.9]	0.187	0.3[0.0-2.7]	0.300
<i>Potassium</i>						
Normal	35 (38.9)	55 (61.1)				
Low	15 (37.5)	25 (62.5)	1.0 [0.5-2.12]	0.964	-	-
<i>HB level</i>						
Normal	20 (29.4)	48 (70.6)				
Low	30 (48.4)	32 (51.6)	2.2 [1.1-4.5]	0.032	1.6[0.6-3.9]	0.343
<i>Sodium</i>						
Normal	47 (39.2)	73 (60.8)				
Low	3 (30.0)	7 (70.0)	0.8 [0.2-3.3]	0.730	-	-
<i>Type of surgery.</i>						
Clean	10 (40.0)	15(60.0)				
Clean contaminated	20(39.2)	31 (60.8)	1.0 [0.4-2.6]	0.948	-	-
Contaminated	13 (46.4)	15 (53.6)	1,3 [0.4-3.9]	0.638	-	-
Dirtyly	4 (57.1)	3 (42.9)	2 [0.4-10.9]	0.423	-	-
<i>Duration of surgery</i>						
< 120min	27 (38.0)	44 (62.0)				
> 120min	20 (50.0)	20 (50.0)	1.0 [1.0-1.0]	0.038	0.8[0.3-2.5]	0.762
<i>Surgical infection</i>						
No	36 (32.7)	74 (67.3)				
Yes	14 (70.0)	6 (30.0)	4.8 [1.7-13.5]	0.003	3.1[0.9-10.3]	0.065

**Predictors of mortality among Paediatric patients with surgical abdominal emergencies admitted at Bugando Medical Centre within study period**

Hyponatremia (p-value= 0.001), hypokalaemia (p-value=0.001) and low haemoglobin (p-value=0.050) were found to significantly predict mortality { **Table 6** }.

**Table-6: Predictors of mortality among Paediatric patients with surgical abdominal emergencies admitted at Bugando Medical Centre within study period**

Patients characteristics	MORTALITY		Pearson chi2	p- value
	DIED	SURVIVAL		
<i>Age</i>	n (%)	n (%)		
Infancy	10 (15.6)	54 (84.4)	- *	0.400
Children	7 (18.9)	30 (81.1)		
Adolescent	2 (6.9)	27 (93.1)		
<i>Gender</i>				
Male	10 (11.6)	76 (88.4)	1.0424	0.307
Female	9 (18.8)	39 (81.3)		
<i>Residents</i>				
Rural	10 (11.6)	76(88.4)	1.8172	0.178
Urban	9 (20.5)	35(79.6)		
<i>Education</i>				
Informal	9 (14.8)	52 (85.3)		
Primary	8 (16.8)	40 (83.3)	- *	0.800
Secondary	2 (9.5)	19 (90.5)		
<i>Duration of presentation</i>				
< than 72hrs	5 (8.6)	53 (91.4)	3.0157	0.082
> than 72hrs	14 (19.5)	58 (80.6)		
<i>Insurance</i>				
Insured	4 (16.0)	21 (84.0)	- *	0.520
No insured	15 (14,3)	90 (85.7)		
<i>Surgeon</i>				
Resister	1 (20.0)	4 (80.0)	- *	0.902
Resident	9 (13.9)	56 (86.2)		
Specialist	6 (4.3)	35 (85.4)		
<i>Potassium</i>				
Normal	4 (4.4)	86 (95.7)	- *	0.001
Low	15 (37.5)	25 (62.5)		
<i>HB level</i>				
Normal	6 (8.8)	61 (91.2)	- *	0.050
Low	13 (21.0)	49 (79.0)		
<i>Sodium</i>				
Normal	14 (11.7)	106 (88.3)	10.8693	0.001
Low	5 (50.0)	5 (50.0)		
<i>Type's surgery.</i>				
Clean	1 (4.0)	24 (96.0)	- *	0.226
Clean contaminated	10 (19.6)	41 (81.4)		
Contaminated	5 (17.9)	23 (82.1)		
Dirtyly	0	7 (100)		
<i>Duration of surgery</i>				
< 120min	7 (8.6)	64 (90.1)	3.3140	0.069
> 120min	9 (22.5)	31 (77.5%)		
<i>Surgical infection</i>				
No	17 (15.5)	93 (84.6)	-*	0.415
Yes	2 (10.0)	18 (90.0)		
<i>Anastomotic leak</i>				
No	17 (14.2)	103 (85.8)	-*	0.439
Yes	2 (20.0)	8 (80.0)		
<i>Dehiscence</i>				
No	18 (14.8)	104 (85.3)	-*	0.735
Yes	1 (12.5)	7 (87.5)		

P-value was calculated by fisher exact test.

## DISCUSSION

Paediatric surgery is a particular challenge due to peculiar physiology and metabolic demand in paediatrics. This study was undertaken to describe our

experience with paediatric surgical abdominal emergencies at Bugando Medical Centre by identifying clinical pattern, early outcome and factors that predict length of hospital stay and mortality among paediatric



surgical abdominal emergencies at Bugando Medical Centre.

This study showed that males 82 (63.1%) were most affected compared to females 48 (36.2%). Male predominance was also reported in other studies (1, 5, 12). Male's predominance to PSAE in this study could be explained by the observation that most of PSAE in this study were infants with intestinal obstruction due to intussusception. Male babies have a high demand of nutrition compared to female due to differences in weight, length, head circumferences and muscles bulkiness which are greater in male infants. Also cell division in male babies occurs more rapidly than those in female. Due to above reasons breast milk often is not enough thus parent initiate early complementary food which tends to increase peristaltic force resulting into proximal bowel dragged into distal segment resulting into intestinal obstruction. Lack of proper nutritional education to rural area, result to the early introduction of food which are not compatible with infancy GIT, could be the reason for most of intestinal obstruction coming from rural area [15,16].

Generally abdominal distension followed by abdominal pain/discomfort appear to be common presentation among PSAE, however in children and adolescent, abdominal pain/discomfort was more perceived than it was in infants. This observation is explained by inability of infants to express pain early during the onset of the condition only to be noticed by parents when distension arises. These findings were similar to studies by Francis M Sakita *at el*.2018 and by Nadia M Hijah *at el*. 2017 [5, 11].

Intestinal obstruction (66.0%) was the commonest clinical diagnosis followed by peritonitis (21.2%), acute appendicitis (3.8%) and pyloric stenosis (3.1%), this is in agreement with other studies [1, 8, 11, 20] but contrary to a study done in Ghana [21], in which the most common clinical diagnosis was typhoid perforation. The observed difference could be explained by the differences in age group between studies, in which the study in Ghana did not involve infants coupled by sanitation differences that exist across different parts of Africa. Our study findings are similar to a previous study done in our setup that involved adults in which it was reported that intestinal obstruction followed by peritonitis and acute appendicitis were common conditions in adults [22]. These findings further narrates the significance of geographic, dietary and sanitary similarities and differences in the disease pattern.

Adolescent age and rural residence were seen to be associated with prolonged hospital stay in this study. Most adolescent presented with peritonitis which post-operative predisposed them to surgical site infections hence prolonged hospital stay. In our study incidence of surgical site infection was seen more in

contaminated surgery and dirty surgery such as peritonitis and appendicitis which were more seen in adolescents hence carry a high risk of surgical site infection post-surgery. Similar observation is made from the study done in Ghana [21]. On the other hand rural residency is often associated with both delay in seeking and receiving appropriate care as is seen in another studies hence predisposing patients from rural area to receive care while already at advanced stages and subsequent postoperative complications [17].

Mortality at our facility had dropped from 28.5% reported by Kileo *et al*. 3years ago to 19.6% in this study signifying marked improvement in quality of care offered to PSAE pertaining reported gaps that included late presentation, delayed diagnosis, delayed surgical intervention and lack of operating theatre space which have all been addressed by improving the ability to investigate, diagnose and offer early intervention. Increased number of emergency operating theatres, increased training to staff allocated for paediatric surgeries, increase number of surgeons including a paediatric surgeon in our institution further explains the improved outcome noted within the 3year period. In comparison to the Tanzania National Hospital where PSAE mortality of 14.5% was reported by Francis M Sakita *at el*. In 2018, our PSAE related mortality is high further addressing the need for availability of enough paediatric surgeons and paediatric surgical intensive care units which are fully functional at the national hospital.

The reported high PSAE related mortality of 26.4% in Ghana by Negusie *et al* in 2018 is accounted for by the existing differences in characteristics of the participants involved in his study in which participants in need of re-laparotomy were recruited into his study there by increased the risk for anaesthesia complication and other surgical complication [24].

In our study death occurred in 19.6% of all PSAE during the study period, electrolyte imbalance in form of hypokalaemia and hyponatremia were significantly associated with mortality. Inadequate intake, impaired absorption and loss through gastrointestinal secretions such as vomiting, diarrheal and fistula can contribute to these imbalances. Hypokalaemia in particular can result in low excitability of syncytium by altering the membrane potential for calcium entry which eventually impairs smooth muscle contraction in the gastrointestinal, skeletal muscles and cardiac muscles which lead to constipation, diminished tendon reflex, paralysis and cardiac arrest. The change suggestive of hypokalaemia in ECG are T- wave flattening's- segment change and arrhythmias [25].

Hyponatremia can result from decrease intake, loss of GI contents can also lead to hyponatremia through prolonged nasogastric tube, vomiting. Post-

surgery, hyponatremia can also occur an excess free water administration coupled with post-surgery increasing secretions of antidiuretic hormone which increase reabsorption of free water from the kidneys with subsequent volume expansion and hyponatremia. Hyponatremia can cause headache, confusion and increased intracranial pressure and lastly coma [25].

Most of the causes of PSAE in this study carry an increase risk for both electrolyte imbalances and low haemoglobin levels, correcting these disfunction raises a possibly of markedly improvement in outcome.

## CONCLUSION

This study has shown that, abdominal distension and abdominal pain are the most common presenting symptoms, while intestinal obstruction and peritonitis are the most common causes of paediatric abdominal surgical emergency at Bugando Medical Centre.

Adolescent age and rural residence are highly associated with prolonged hospital stay, while electrolyte imbalance and low haemoglobin levels are associated with mortality among Paediatric Surgical Abdominal Emergency. Mortality in this age group remains high despite a marked decrease in the past three years, correcting the electrolyte imbalances and haemoglobin level before surgery can markedly improve the outcome by decreasing the mortality in particular.

## ACKNOWLEDGEMENT

We acknowledge the parents/guardian of the study participants, participants themselves and all department involved in management of these cases at CUHAS/BMC.

### Authors' contributions

PK and RK played equal roles in the preparation of this case report. The other Co-authors contributed in caring and managing the patients. All authors read and approved the final manuscript.

### Funding

The cost of care offered to all under-five year of age was waved by the hospital administration as per Government protocols, the cost of care offered to those above five years of age was contributed by the patients family and hospital administration. The cost of preparing this manuscript was covered by the authors, and Directorate of research and publication-Catholic University of Health and Allied Sciences.

### Ethics approval, consent to participate and publish

Ethical clearance to conduct the research and consent to publish this research report was granted by the joint Catholic University of Health and Allied Sciences/Bugando Medical Centre Research and Ethical

review committee with research certificate number CREC/453/2020. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

### Conflict of Interest

All authors declare no conflict of interest.

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**Cite This Article:** Peter Kibunto, Richard Kiritta, Leonard Washington, Geoffrey Giiti, Alicia Massenga, Benson Kidenya, Fabian Massaga, Samwel Byabato (2022). Clinical Pattern and Predictors of Early Outcome of Paediatric Surgical Abdominal Emergencies at Bugando Medical Centre-Mwanza Tanzania. *East African Scholars J Med Surg*, 4(2), 27-35.