

ACUTE ABDOMEN IN CHILDREN AS SEEN IN THE  
PAEDIATRIC SURGICAL UNIT AT KENYATTA NATIONAL HOSPITAL:  
PRESENTATION AND PROBLEMS OF DIAGNOSIS.

BY

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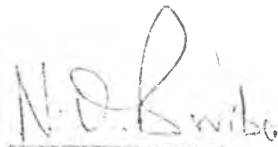
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## SUMMARY

Four hundred-fifty two children were admitted to the Paediatric Surgical Unit (PSU) over a five month period (10th August, 1985 to 9th January, 1986). One hundred-one children (22.3%) admitted with a diagnosis of acute abdomen were selected for the study. The mean age of the 101 children was 42.75 months (range 3 days to 12.5 years). Fifty children (49.5%) had acute intestinal obstruction including strangulated/incarcerated hernias. Twelve (66.7%) of the 18 children with strangulated/incarcerated hernias had umbilical hernias. The other causes of acute intestinal obstruction were round worms, volvulus, congenital bowel atresia and enteric cysts, fecal impaction and post-operative adhesions. The peak incidence of round worm intestinal obstruction was in the age group 24-59 months. Volvulus was seen in children aged 5 years and above and occurred as a complication of round worms or post-operative adhesions.

Fifteen children (14.8%) had acute appendicitis, the youngest child was 2 years and the oldest was 12.5 years. Perforated appendix was seen in 5 (33.3%) children and appendiceal abscess/mass in another 5 (33.3%). These complications of acute appendicitis were significantly associated with long duration of illness before surgical consultation was sought,  $p < 0.05$  and were mainly due to delay in making correct diagnosis.

Fourteen (13.9%) children had intussusception; with age range 2.5 months to 2.5 years. Eleven children (78.6%) were below 11 months with a peak incidence (57%) between 5 months and 9 months. No sex difference was noted in infants under 6 months but there was a tendency to more males being affected in older infants. Complications (perforated or gangrenous bowel) were seen in 8 (57.1%) of the infants and out of these 8, 5 (62.5%) died. All infants admitted to the PSU below 6 months of age had complications at operation and contributed to 80% of the mortality. Complications and mortality were significantly associated with long duration of illness,  $p = 0.02$  and this was mainly due to delay in diagnosis.

Twenty two (21.8%) children had acute abdomen due to various causes classified here as miscellaneous for convenience. These included 6 infants with congenital pyloric stenosis and 2 infants with Hirschprung's disease. These satisfied the criteria for entry into the study. In 5 children no cause for the acute abdomen could be established.

Of the 79 children with acute abdomen due to acute intestinal obstruction (including strangulated/incarcerated hernias), intussusception and acute appendicitis, 36 (45.6%) had complications at operation which was significantly ( $p = 0.001$ ) associated with long duration of illness. 24 (67%) of these 36 children had 2 or more medical evaluation before correct diagnosis was made.

## INTRODUCTION

Acute abdomen can be defined as a medical or a surgical condition in which an acute decision must be made and appropriate management instituted to avoid morbidity and mortality (1). Acute abdominal illness in an infant or a child is like an "Unopened Christmas Package" (2). Even after careful questioning, inspection and palpation, the cause may still remain unknown.

Evaluation of abdominal pain in children poses a major challenge for the Paediatrician and Paediatric Surgeon alike. The very young child cannot give any history and that given by an older child is seldom reliable. The Paediatrician must therefore take history by sorting through the parent's observations of common nonspecific symptoms. Quite often, the parents are over anxious about their child's illness and may therefore give incoherent history (2,3,4).

Acute abdominal illness can be considered when the following symptoms present: abdominal pain, vomiting, collapse, abdominal muscle rigidity and abdominal distension. Most severe lesions present with two or more of these main symptoms. If any of the above main symptoms is considered along with either fever, diarrhoea or constipation, a possible cause for the acute abdomen may be found. However, abdominal pain may be the only complaint and this by itself is enough to warrant further evaluation (1).



The Paediatrician and other medical workers, other than surgeons, are usually the first to be consulted by a parent of a sick child. Therefore, they must be familiar not only with those medical conditions that can present as an acute abdomen but also those that present as surgical abdominal emergencies.

Among medical conditions that can present as an acute abdomen in an infant or a child are: sickle cell crisis, diabetes - mellitus, porphyria, typhoid fever, malaria, food poisoning, heavy worm load, uraemia, urinary tract infection, pneumonia, viral gastroenteritis and mesenteric adenitis. Any of these can mimick a surgical emergency like an acute appendicitis or intestinal obstruction. More distressing is the fact that any of these conditions can herald an acute appendicitis and both conditions can co-exist (1,2,3,4,5,6,7,8). Simple tests like a urinalysis for sugar, albumin, the Schwartz-Wartson reaction for porphobilinogen, sickling test and a blood slide for malaria parasites, would provide assistance in eliminating some of the above conditions.

Of the surgical abdominal emergencies, acute appendicitis is the commonest illness in childhood requiring surgery (3,4,5,6). However, diagnosis in children can be difficult especially in the very young. Usually a child is seen at some point earlier in his illness and sent home with some medication only to turn up later with a perforation or peritonitis. Graham, et al (9) in a retrospective study

reviewed 183 children aged less than six years admitted to Texas Children's Hospital with a preoperative diagnosis of acute appendicitis. They found that of the 155 children with proved acute appendicitis 83(57%) were seen at some point earlier in their illness and managed medically without recognising the possibility of acute appendicitis in them. At subsequent operation, 73(83%) had a perforation or complication thereof. Other surgical abdominal emergencies in childhood to be considered in the diagnosis of an acute abdomen are intussusception, which poses diagnostic problems especially when there is gastroenteritis (10); strangulated hernias and meckel's diverticulum. Post-operative adhesions must be considered in a child with acute intestinal obstruction who has a surgical scar on the abdomen, especially because of the risk of associated volvulus which carries high morbidity and mortality (11). Intestinal obstruction with ascaris is a major problem in children and is associated with high morbidity and mortality when complicated by volvulus or intussusception (12,13). The Paediatrician must be aware that history of passing out worms or vomiting worms is found only in about 20-30% of children found to have ascaris in their gut (13).

Factors considered to result in increased morbidity of acute abdomen in children are: difficulty in making a diagnosis and failure to recognise early serious symptoms and signs resulting in delay in seeking surgical consultation. While it is recognised that an acute abdominal

OBJECTIVES

1. to find out the causes of acute abdomen in children aged 13 years and below admitted to the Paediatric Surgical Unit (PSU).
  
2. to determine to what extent delay in diagnosis and surgical consultations affect the overall outcome of children with acute abdomen.

## MATERIALS AND METHODS

The study took place in the Paediatric Surgical Unit (PSU) Kenyatta National Hospital (KNH) from August 10th, 1985 to 9th January, 1986. This unit admits children of 13 years and below who have acute or chronic illnesses considered to require surgical management. The unit also acts as a referral centre for the whole country for those conditions that require more complicated Paediatric Surgery. The unit has 40 cots, 8 incubators and 6 beds. Children above 3 years are admitted alone while those below this age are admitted with their mothers. Occasionally a mother of an older child (above 3 years) who is very sick may request to be allowed to stay for the first day or two and this is usually granted.

This area of study was chosen because it gives a chance to evaluate the role of the Paediatrician and those under him or her in conditions considered otherwise surgical but in which the Paediatrician has a lot of responsibility in influencing the overall outcome as discussed earlier in the introduction.

The author saw all children admitted with abdominal illness. The following criteria given by Sir Zachary Cope (1) for the diagnosis of acute abdomen were used to select patients for the study: Any of the following major symptoms:

- . Abdominal pain
- . Vomiting
- . Collapse

. Abdominal muscular rigidity

. Abdominal distension

with either of the following: fever, diarrhoea or constipation.

These symptoms were determined by taking a detailed history from the mother, father or guardian. Enquiry was made into the time of onset of illness, whether acute or gradual, duration of each symptom and whether medical care was sought. If medical care was sought, the day of onset of illness and the place where this was sought (i.e. health centre, district hospital etc.) were recorded.

The author sought from the parents/guardian what was done for the child after seeking medical help as indicated in the questionnaire (appendix). Whenever, the author found a parent/guardian who did not seek medical care early, reasons for this were sought and recorded in the questionnaire.

Some mothers after seeking the first medical consultation stayed away for long and on subsequent evaluation, the child was found to be too sick. Reasons for not seeking a second or third consultation early were sought and recorded in the questionnaire under 'Other Information'. Any relevant previous medical/surgical history was also sought.

The author interviewed the parent/guardian at the time of admission of the child to the PSU. Information on any child who was unaccompanied at the time the author made visits to the unit, was obtained during visiting hours or any time convenient to the parent or guardian.

The origin (place) of surgical consultations to the Paediatric Surgeons was recorded. Children from the other Paediatric Wards within KWH were not included in the study unless admitted to the PSU.

The author with the Paediatric Surgical Registrar (Resident) performed physical examination and entered these findings in the questionnaire as indicated. Where emergency surgery was performed before the patient was examined by the author, the pre-operative physical findings of the Paediatric Surgical Registrar were recorded and the author proceeded to take the history as described above.

The author then recorded the planned management of the patient by the Paediatric Surgeon as conservative or operative. In all operative cases the time interval between admission and operation as well as the findings at operation were recorded. The author made follow up visits on all patients during their stay in the unit and recorded the outcome as indicated in the questionnaire.

All patients had plain abdominal X-rays taken before admission to the PSU. Some came with X-rays from their referral units. Patients with clinical diagnosis of acute appendicitis without complication were not routinely X-rayed.

The author collected all the available X-rays of the patients admitted into the study and had them reported by one consultant Radiologist. Radiological report was not available at the time of admission to the PSU or at the time of correction.

The reason for this is that reporting X-rays and dispatching them to the relevant areas takes a long time. Thus, a doctor wanting an urgent radiological report has to actively look for a Radiologist. This is only possible during the official working hours - the Radiologist on call does not routinely report on X-rays. The consultant Radiologist who reported on these X-rays was not aware of the operative findings as these were not indicated in the requesting form.

Children admitted to the unit with acute abdomen due to trauma were excluded from this study.

RESULTS

Four hundred-fifty two children were admitted to the PSU with various surgical problems. Of these, 101 were admitted with acute abdomen due to various causes (excluding trauma) and their results are presented.

Table I

Analysis of 101 children with acute abdomen by age and sex.

Sex				
Age (months)	Male	Female	Total	%
< 3	13	11	24	23.8
3 - 11	16	5	21	20.8
12 - 23	2	1	3	3.0
24 - 59	13	7	20	19.8
≥ 60	15	18	33	32.6
Total	59	42	101	100.0

This table shows that there was no significant sex difference,  $p > 0.05$ .

53(52.4%) of the children were  $\geq 24$  months in age and 48(47.6%) were below 24 months.



Table II

Analysis of 101 children with acute abdomen by the cause.

Causes of acute abdomen ..	No. of cases	% Total
Intestinal obstruction including strangulated/incarcerated hernias	50	49.5
* Miscellaneous group	16	15.8
Acute appendicitis	15	14.8
Intussusception	14	13.9
<sup>x</sup> Congenital pyloric stenosis	6	6.0
Total	101	100.0

\* See table III

x Only those that satisfied the criteria for entry into the study

Table III

Composition of the miscellaneous group

Causes of acute abdomen	No. of cases	% Total
Primary peritonitis	4	25.00
No abnormality found on laparotomy	3	18.75
Mesenteric adenitis	2	12.50
Unconfirmed-managed conservatively	2	12.50
Hirschprung's disease	2	12.50
<sup>x</sup> Diabetes mellitus	1	6.25
Perforated ileum with peritonitis (no cause found)	1	6.25
Acute hydrocoele (presented like strangulated inguinal hernia)	1	6.25
Total	16	100.00

\* One infant aged 5 months presented with features of intussusception. Spontaneous reduction probably occurred at time of preparation for operation - not unusual.

x A 3 year 3 month old girl found to have diabetes mellitus and bronchopneumonia on admission to PSU had been referred from a district hospital (where she was an in-patient for one week) as acute intestinal obstruction. Transferred to Paediatric General Ward. Died 2 weeks later and at post-mortem found with perforated duodenal ulcer reported to have an old ulcer.

The rest of the data concentrates on the 79 children with acute abdomen due to intestinal obstruction including strangulated/incarcerated hernias, acute appendicitis and intussusception. These made up 78.2% of all children admitted to the PSU with a diagnosis of acute abdomen.

Table IV

Analysis of the 79 children by age.

Age: (months)	No. of patients	% Total
$< 3$	15	19.1
3 - 11	16	20.2
12 - 23	5	6.3
24 - 59	20	25.3
$\geq 60$	23	29.1
Total	79	100.0

54.4% of children were  $\geq 24$  months and 45.6% were below 24 months in age.

Table V Analysis of 79 children by age and cause of acute abdomen.

Causes	No. of patients by age in months					Total patients
	< 3	3-11	12-23	24-59	≥ 60	
Incarcerated/strangulated hernias						
- umbilical	2	4	1	5	-	12 6 } 18
- inguinal	3	1	0	2	-	
Acute appendicitis	-	-	-	2	13	15
Intussusception	1	10	1	2	-	14
Congenital bowel atresia, bands, stenosis, cysts and meconium plug	* 8	1	-	-	-	9
Roundworms	-	-	2	5	1	8
Volvulus	-	-	-	0	7	7
Fecal impaction	1	-	1	2	2	6
Post-operative adhesions	-	-	-	2	-	2
Total	15	16	5	20	23	79

\* Five (33.3%) of all infants below 3 months of age had congenital bowel atresia (4 infants had small bowel atresia and one had large bowel atresia). All were neonates less than 10 days old (range 3 days to 8 days).

Enteric cyst was found in two infants, 2 months and 3 months of age, who had a history of subacute intestinal obstruction since birth but symptoms got worse with age.

Five (33.3%) of infants below 3 months of age had incarcerated or strangulated hernias (3 had inguinal hernias and 2 had umbilical hernias). All inguinal hernias were seen in males.

Intussusception was the commonest cause of acute abdomen in the age group 3-11 months accounting for 10 (62.5%) of all causes in that age group. The youngest age for intussusception was 2.5 months. One infant (6 months old) had mesenteric adenitis with intussusception.

Incarcerated/strangulated hernias and roundworm intestinal obstruction were the commonest causes of acute abdomen in the age group 12-59 months, accounting for 8 (32%) and 7 (28%) respectively of all causes in that age group. The peak age incidence for roundworm intestinal obstruction was 24-59 months accounting for 5 (62.5%) of all cases of roundworm intestinal obstruction.

Acute appendicitis and volvulus were the commonest cause of acute abdomen in the age group  $\geq 60$  months accounting for 56.5% and 30.4%, respectively of all causes in that age group. The youngest age of acute appendicitis was

two years and was in association with roundworm intestinal obstruction. The youngest age for volvulus was five years. Volvulus was seen in association with post-operative adhesions (3 cases); roundworms (2 cases); round-worm and intussusception (1 case) and mesenteric adenitis (1 case).

Table VI

Analysis of 79 children by duration of illness prior to admission to PSU and the finding of complications at operation.

Duration (days)	No. of patients without complications	No. of patients with complications	Total
1	11	5	16
2	10	0	10
3	9	8	17
4	6	3	9
5	2	2	4
≥ 6	5	18	23
Total	43	36	79
Mean duration (days)	2.95	4.92	

Patients with complications at operation had mean duration of illness of 4.92 days while those without complications had mean duration of illness of 2.95 days. This difference was highly significant,  $p = 0.001$ .

The complications referred to above were: gangrenous bowel, perforated bowel with peritonitis or abscess formation.

Table VII

Analysis of 79 patients by the referring health facility on admission to PSU.

Place of referral	No. of patients	% Total
Kenyatta Hospital	34	43.0
District Hospital	20	25.3
* Provincial Hospital	10	12.7
City Clinics/Health-centres	6	7.6
Private Clinics/Mission Hospital	5	6.3
Maternity Nursing Clinics	4	5.1
Total	79	100.0

\* Machakos Provincial Hospital (9 patients) had no anaesthetist most of the time. The other patient was a 4 day old neonate from Nyeri Provincial Hospital with jejunal atresia.

The 34 patients from Kenyatta Hospital were referred to the Paediatric Surgeon from the following areas:

Paediatric Filter Clinic (PFC) ----- 20 patients  
 Casualty ----- 6 patients  
 Paediatric Observation Ward ----- 5 patients  
 Infectious Diseases Hospital (IDH Block III) ----- 3 patients.

57(72%) of the 79 patients were admitted to PSU from an out-patient facility and 22(28%) were from an in-patient facility.



Table VIII

Analysis of 57 patients admitted to PSU from an out-patient facility by number of medical consultations and complications at operation.

No. of medical consultations prior to admission to PSU	No. of patients without complications	No. of patients with complications	Total
1	24	10	34
2	8	3	11
3	0	7	7
4	0	2	2
≥ 5	0	3	3
Total	32	25	57
Sum consultations	40	66	
Mean consultations	1.25	2.64	

Patients found with complications at operation sought medical evaluation more times (mean consultations 2.64) than those without complications (mean consultations 1.25) and this difference was found to be statistically significant,  $p = 0.003$ .

ANALYSIS OF 22 PATIENTS ADMITTED FROM PSU FROM AN IN-PATIENT FACILITY

Table IX Analysis of 22 patients by the referral unit, duration of stay at the referral unit and operative findings at PSU

Duration in days prior to admission to PSU	DISTRICT HOSPITAL		PROVINCIAL HOSPITAL		P O W		IDH BLOCK III		OTHERS		Total
	No. of patients without complications	No. of patients with complications	No. of patients without complications	No. of patients with complications	No. of patients without complications	No. of patients with complications	No. of patients without complications	No. of patients with complications	No. of patients without complications	No. of patients with complications	
1	0	0	0	1	1	2	0	0	0	0	4
2	1	0	0	0	0	1	1	2	0	0	5
3	3	2	1	2	0	1	0	0	3	1	13
Total	4	2	1	3	1	4	1	2	3	1	22

Three (75%) of the 4 patients referred from provincial hospital; 4(80%) of the 5 patients referred from POW and 2(67%) of the 3 patients referred from IDH had complications at operation on admission to PSU.

The following 5 case reports are presented to illustrate the observations in tables VI to IX, with particular reference to Kenyatta National Hospital, provincial and district hospitals.

Case 1

A twelve year old girl presented on day one of the illness to a city clinic with history of abdominal pain localised to right lower abdomen and vomiting. She was given some medicine to take home. She reported to PFC on the third day of illness with above complaints and loose small stools. She was again given some medicine to take home. She reported to PFC again on the fourth day of illness with the same complaints above but which had now got worse and in addition she had not opened bowels since the previous visit. She was again sent away on some medication in addition to what she was already taking. On the fifth day of illness, the mother decided to come to casualty (general surgery room) and a diagnosis of perforated appendix was made. At subsequent operation after admission to PSU, perforated appendix with peritonitis was found. She had made a total of four consultations.

Case 2

A five month old infant, admitted to a district hospital on day one of the illness with a history of diarrhoea and vomiting. On 4th day, the infant was discharged after diarrhoea was noted to have decreased. On the

5th day (at home), the mother noted the infant looked 'unwell', was crying too much, continued to vomit and passed only very small fluid stools. She took him to PFC on the same day and was referred to IDH (diarrhoea side block III) for admission. After one day in IDH (6th day of illness) the mother noted that the baby was only passing little mucus and no stools, was now vomiting a lot and the abdomen looked distended. On 2nd day in IDH (7th day of illness) the mother noted some little blood with mucus coming from the anus and the baby had become weak, no longer crying as before. He was then reviewed and surgical consultation was sought for intussusception. At operation after admission to PSU on the same day he was found to have ileo-colic intussusception with perforated bowel which was resected. He eventually recovered after three weeks stay in the ward.

### Case 3

A ten year old boy presented to a district hospital on day one of the illness with history of abdominal pain that was localised to the right lower abdomen and vomiting on and off. He was given some medication to take home. He reported again on day two with the same pain and vomiting which had become worse. He had also become anorexic. He was again given some medication to take home. On the 4th day of illness he reported again to the hospital with generalised abdominal pain, constipation and vomiting. A diagnosis of perforated appendix with

peritonitis was made and he was referred to Kenyatta PSU for management. At operation the diagnosis was confirmed and in addition he had started forming adhesions. He made a total of 3 consultations.

#### Case 4

A nine year old girl presented to PFC on the 7th day of illness (after the parents had tried some home medications which failed) with history of generalised abdominal pain which was intermittent. She also had constipation and vomiting which was initially on and off but became more frequent. She was admitted to POW on the same day. The abdominal pain persisted and became more frequent. The vomiting also persisted. On the 3rd day of admission (10th day of illness), the mother noted the abdomen had become swollen, the pain had become almost continuous, vomiting increased and generally looked very sick. She was reviewed and surgical consultation sought for peritonitis. At subsequent operation after admission to PSU she was found to have perforated ileum with roundworms. In retrospect, plain abdominal X-ray showed small bowel packed with roundworms.

#### Case 5

A six month old infant presented to a provincial hospital on day one of the illness with history of crying too much, refusal to feed, diarrhoea (watery stools) and vomiting. The infant was admitted for treatment. On day 2 of the illness the infant's condition remained the same. On day 3 the mother noted that the diarrhoea had become

less but there was mucus. The vomiting, crying too much and refusal to feed had not changed since the first day of the illness. On day 4 the mother noted the infant to have passed blood with mucus and described seeing something like a small piece of 'meat' passed out with mucus. On day 5 the abdomen got distended and the infant lay very 'quiet and dull', there was no more passage of mucus and blood. At this point intussusception was diagnosed and the infant referred to Kenyatta PSU for management. At operation, which was done within 4½ hours of admission to PSU, a partially gangrenous ileocolic intussusception was found. This was resected.

Nineteen (24%) of the patients were first seen by a Paediatrician or those working under him (interns or Paediatric residents), before surgical consultation was sought. Fifty four (69%) patients were seen by medical officers at various health care units (District hospitals, PFC - Kenyatta Hospital, casualty and others) and 6(7%) were seen by clinical officers.

Sixty four (81%) of the parents sought medical care early for the illness of their children. Eight (10%) of the mothers made the first medical consultation (for their children) early but subsequent consultations were delayed. This resulted in complications seen at operation. The time period (in relation to the onset of illness) at which these consultations

were sought is shown below:

	<u>No. of mothers</u>
a) medical consultation on day 1 and day 5 of the illness	5
b) medical consultation on day 2, day 6 and day 8 of the illness	2
c) medical consultation on day 1, day 3, day 6 and day 8.	1
<hr/>	
Total	8
<hr/>	

The reasons for delay in seeking subsequent medical consultations by the 8 mothers above are shown in the table below.

Table X-A Analysis of reasons given by the 8 mothers for delayed subsequent consultations following an early first medical consultation.

<u>Reasons</u>	<u>No. of mothers</u>
1. was trying to give medicine as instructed	4
2. kept on coming and being turned away that she was not giving medicine as instructed	2
3. did not know how long should give medicine so decided to continue until all the medicine was given	1
4. felt child was improving	1
<hr/>	
Total	8
<hr/>	

Seven (9%) of the mothers sought the first medical consultation for their children late when the disease had progressed to complications. Reasons for their behaviour were sought and are shown in the table below.

Table X-3 Analysis of reasons given by the 7 mothers for late first medical consultation.

<u>Reasons</u>	<u>No. of mothers</u>
1. tried home remedy with aspro, cafenol etc.	3
2. did not think illness serious	2
3. no reason	2
<hr/>	
Total	7
<hr/>	

In 9(25%) of the 36 patients found with complications at operation, the following surgical related factors may have contributed:

	No. of patients affected
1. unavailability of an anaesthetist, blood or free theatre	5
2. delay in responding to surgical consultation and/or in deciding on operation	4
<hr/>	
Total	9
<hr/>	



Table XI Analysis of the outcome of 79 patients with acute abdomen.

Case	OUTCOME					Total patients	Total deaths
	Viable gut		Perforated/gangrenous gut				
	Recovered	Died	Recovered	Died			
Incarcerated/strangulated hernias	14	-	4	-	18	0	
Acute Appendicitis	5	-	10	-	15	0	
Intussusception	6	-	3	5	14	5	
Congenital: bowel atresia, bands, cysts, stenosis, meconium impaction	4	2	2	1	9	3	
Roundworms	5	-	2	1	8	1	
Volvulus	-	-	4	3	7	3	
Fecal impaction	6	-	-	-	6	0	
Post-operative adhesions	1	-	1	-	2	-	
<b>Total</b>	<b>41</b>	<b>2</b>	<b>26</b>	<b>10</b>	<b>79</b>	<b>12</b>	

See footnote next page.

Footnote to Table XI

Sixty seven (34.7%) of the patients recovered, 12 (15.3%) died. Of the 67 patients who recovered, 41 (61.8%) had no complications found at operation while 26 (38.2%) had complications found at operation. Acute appendicitis contributed to 10 (27.8%) of the 36 patients found with complications at operation; intussuception 8 (22.2%); volvulus 7 (19.5%) roundworms 3 (8.3%) and others 8 (22.2%). Intussuception contributed to 5 (41.7%) of the deaths; volvulus contributed to 3 (25%) and others 4 (33.3%).

The rest of the data concentrates on some aspects of each of the three main causes of acute abdomen in the 79 children.

ACUTE INTESTINAL OBSTRUCTION EXCLUDING INTUSSUSCEPTION

See table XIII overleaf.

Table XII A: Frequency of symptoms on admission to PSU in 50 children with acute intestinal obstruction.

Symptoms	Diagnosis - No. of patients						Total
	Roundworms	Volvulus	Adhesions	Fecal impaction	Congenital bowel atresia, bands, cysts and meconium impaction	Hernias	
Vomiting	7	6	2	4	7	17	43
Constipation	4	4	2	6	7	13	36
Abdominal Distension	4	3	1	6	8	11	33
Anorexia	2	5	2	4	1	12	26
Abdominal pain	5	6	2	3	-	9	25
Excessive crying	2	-	-	1	2	10	15
Vomiting worms	2	1	-	-	-	-	3
Passing out worms	2	-	-	-	-	-	2
Diarrhoea	2	-	-	-	-	-	2
Vomiting and passing out worms	1	-	-	-	-	-	1

Table XII B: Frequency of physical signs on admission to PSU in 50 children with acute intestinal obstruction

Physical signs	Diagnosis - No. of patients						Total
	Roundworms	Volvulus	Adhesions	Fecal impaction	Congenital bowel atresia, bands, cysts and meconium impaction	Hernias	
Dehydration - MILD	6	1	1	1	2	7	33
- MODERATE	1 ] 7	3 ] 6	1 ] 2	1 ] 2	4 ] 6	3 ] 10	
- SEVERE	0	2	0	0	0		
Abdominal tenderness	5	5	1	4	1	* 16	32
Mass on abdomen	1	-	1	-	-	* 17	19
Abdominal muscle rigidity	1	2	-	-	-	-	3
Fever	1	-	-	-	1	1	3
Blood on finger on rectal exam	2	-	-	-	-	-	2

\* tenderness was in most cases localised to hernia site and mass on the abdomen was the hernia itself.

ACUTE APPENDICITIS

Table VIII

Frequency of symptoms and signs in 15 patients with acute appendicitis on admission to PSU.

<u>Symptoms</u>	No. of patients	Per cent of total patients
Abdominal pain --- Localised	12	100
--- generalised	3	
Vomiting	11	73
Anorexia	7	47
Constipations	4	27
Diarrhoea	2	13
Abdominal distension	1	7
<u>Physical signs</u>		
Abdominal tenderness -- Localised	9	100
--- generalised	6	
Abdominal muscle rigidity	14	93
Abdominal distension	7	47
Fever temp. $\geq 38^{\circ}\text{C}$	5	33
Abdominal mass	2	13

Table XIV

Analysis of 15 patients with acute appendicitis by duration of illness and complications.

Duration in days on admission to PSU	No. of patients with no complications	No. of patients with complications		Total
		Perforated appendix with peritonitis No. of patients	Appendiceal abscess/mass No. of patients	
1	2	0	0	2
2	0	0	0	0
3	2	2	2	6
4	1	1	0	2
5	0	2	3	5
Total	5	5	5	15
Mean duration (days)	2.4	4.2	4.8	

$p < 0.05$  for inflamed appendix vs the others.

Patients with complications at operation had mean duration of illness of 4.2 and 4.8 days (perforated appendix and appendiceal abscess respectively) as opposed to those without complications with mean duration of illness of 2.4 days. This difference was found to be significant,  $p < 0.05$ .

INTUSSUSCEPTION

Table XV

Frequency of symptoms and signs in 14 patients with intussusception on admission to PSU.

Symptoms	No. of patients	Per cent of Total Patients
Vomiting	14	100
Passing blood or mucus per rectum	14	100
Excessive crying	13	93
Abdominal distension	12	86
Refusal to feed	11	78
Abdominal pain	1	7

Physical signs

Dehydration - moderate - 7	} 14	100
- mild - 5		
- severe - 2		
Rectal examination - blood on finger	14	100
- mass felt	11	78
Abdominal distension	12	86
Abdominal tenderness	6	43
Mass palpated on abdomen	6	43
Fever Temp. $\geq 38^{\circ}\text{C}$	2	14

Thirteen (93%) of the patients had vomiting as an initial symptom. Seven (50%) had both diarrhoea and vomiting as initial presenting symptoms. Two (14%) had bloody diarrhoea at the onset of the illness.



Table XVI

Analysis of 14 children with intussusception by duration of illness, complications and mortality.

Duration in days on admission to PSU	Viable gut		Perforated or gangrenous gut		Total patients
	Recovered	Died	Recovered	Died	
< 2	1	0	0	0	1
2 - 4	5	0	0	0	5
5 - 7	0	0	3	3	6
8 - 10	0	0	0	1	1
≥ 11	0	0	0	1	1
Total	6	0	3	5	14
Mean duration (days)	2.7		7.1		

Patients found with perforated or gangrenous gut had mean duration of illness of 7.1 days as opposed to those with viable gut with mean duration of illness of 2.7 days. This difference was statistically significant,  $p = 0.02$ .

## DISCUSSION

Acute abdominal illness in children is an important Paediatric problem which should be of concern to the Paediatricians just as it is to the Paediatric Surgeons.

Many workers (6,7,9,14) observed that medical workers, other than surgeons are not alert in 'picking up' those causes of acute abdominal illness in children that require immediate surgical intervention; and have a tendency to wait-and-see attitude until the symptoms become obvious thus resulting in complications seen at subsequent operation. This study showed that in 24(67%) of the 36 patients found with complications at operation, their parents had made 2 or more visits to their health facilities. It was further noted that the same 36 patients had significantly ( $p=0.001$ ) longer duration of illness (mean 4.94 days) than those (43 patients) without complications (mean 2.95 days). In only 7 patients, was the medical consultation sought late by their parents when their disease had progressed to complications. In another 3, their parents sought the first medical consultation early but subsequent ones were delayed. This resulted in these children staying with their disease longer predisposing to development of complications. However, it should be noted that the same parents made several visits to their health facilities, for example, one mother sought medical care on day 1,3,6 and 8 of the illness of her child. It

would therefore appear that those consulted failed to 'pick up' the disease at each subsequent visit resulting in longer duration of illness and subsequent development of complications.

The long duration of illness and the many medical consultations made by the parents of these children (well illustrated by the 5 case reports) would tend to reflect on the failure by those consulted to recognise the worsening signs and symptoms early, thus resulting in delay in seeking surgical consultation. Savrin et al (14), in a study of 49 children who had appendicectomy done, noted that 22(45%) children found with appendiceal rupture had made a total of 33 visits to their physicians who failed to recognise the worsening symptoms and signs early. To quote them, "It is the primary physician who must be painstakingly thorough in the evaluation of the child with abdominal pain and must be encouraged to seek surgical consultation when indicated". In the same study, they observed that 55% of the parents sought medical evaluation for their children when complications had occurred and suggested that the symptoms of "Acute appendicitis" be explained to the parents who should be encouraged to seek medical care early.

Savrin and co-workers (14) also analysed the type of physicians who first saw the 22 children found with ruptured appendix at operation. They found that 59% were paediatricians, 29% general practitioners, 8% general

surgeons and 4% urologists. In this study, majority of the patients (60%) were first seen by medical officers. Paediatricians/Paediatric Residents saw 24% and the remaining 7% were seen by clinical officers. This country unlike Columbus where Savrin and co-workers did the study has a small number of Paediatricians.

While delay in making correct diagnosis emerges as the main cause of morbidity in the children seen in this study, several other factors contributed to it. Among these were: delay in responding to surgical consultation and deciding on operation; lack of immediate theatre facilities; unavailability of an anaesthetist and lack of obtaining blood on time. It is also noteworthy that the PSU has only been fully operational for the last 5 years or so and has a skeleton staff.

Evaluation of abdominal pain in childhood poses a major challenge for the Paediatrician and Paediatric Surgeon alike. Hatch (3) in his work on acute abdomen in children with special reference to acute appendicitis and its diagnosis made this observation and to quote him, "The child with acute abdominal pain remains a most difficult diagnostic dilemma for even the most astute clinician". A logical approach therefore would be to have a clear picture of the most frequent causes of acute abdomen for the age group of the child being evaluated. These causes are described below for various age groups.

The age below 12 months

Excluding pyloric stenosis and Hirschprung's disease, the commonest cause of acute abdomen were intussusception 33.5%, incarcerated/strangulated hernias 32% and congenital abnormalities of the gastrointestinal tract (GIT) 29%. These congenital abnormalities of the GIT were: atresia (small bowel 4 neonates and large bowel one neonate), duplication of the bowel and enteric cysts. These were all seen in the first week of life. Between 3 and 11 months of age, intussusception was the commonest cause of acute abdomen accounting for 62.5% of all causes in this age group and 71.4% of all cases of intussusception seen in this study. The peak incidence of intussusception was seen between 5 and 9 months of age where there were 8(57%) cases. No sex difference was noted in those under six months. However, there was a tendency to more males being affected than females in older children. Ravnich (10) has made similar observation that 60-65% of infants with intussusception were below 12 months of age with a peak incidence between 5 and 9 months. He noted a male to female ratio of 3:2 in older infants but no sex difference in younger infants.

The clinical presentation of an infant with intussusception is variable. Also to note is that symptoms of onset tend to differ somewhat from symptoms which are most prominent at the time the infant is seen (10). In this study, 100%

of infants had passage of blood per rectum at the time of admission to PSU but only 14% had this as an initial symptom.

Ravtich also noted that symptoms and clinical signs differ between young infants and older ones, and between these and older children. He observed that vomiting was a very common symptom in the very young and occurred early while colic abdominal pain was seen in older children (10). This study has made similar observations. 93% of the infants had vomiting as an initial symptom while colic abdominal pain was a complaint in one child aged  $2\frac{1}{2}$  years. This study had only 2 children of this age.

Twelve (86%) of the infants had abdominal distension at the time of admission to PSU. Many of these were very sick and were found with complications at operation. Abdominal distension is usually a late sign (4,5,10). In 78%, a mass was felt on rectal examination. This figure is much higher than that given by Jones (4) of 10%. This difference is due to the fact that most of the infants were seen late in their disease and therefore the apex of the intussusception would have reached low enough to be felt. A mass on the abdomen was palpable in only 43% of the patients. This again differs from that given by Jones of 66%. This difference is probably due to the fact that the patients were seen late when complications had set in.

The diagnosis of intussusception is largely clinical. Plain X-rays of the abdomen are of limited value. One should see a round soft tissue mass in the left hypochondrium which represents the head of the intussusception. The finding of fluid levels is a late sign (4,5,10) by which time the clinical features are obvious but diagnosis should be made early before these features set in. Where facilities exist, a barium enema is most helpful especially in doubtful cases and will show a typical meniscus at the apex of intussusception (4,5). After evacuating the barium a 'coiled spring' appearance is seen which is caused by some barium extending between the layers of the intussusception.

Early diagnosis and prompt reduction is absolutely essential for the mortality increases sharply with delay in diagnosis and therefore in reduction (4,10). In this study 5(62.5%) of the 8 infants found with complications at operation died. The mortality was highest in those less than 6 months of age and contributed to 4(80%) of the 5 deaths due to intussusception. These complications were significantly associated with the long duration of illness before surgical consultation was sought and reflected on delay in diagnosis,  $p = 0.02$  Table XVI.

Age 12-23 months and 24-59 months

The commonest cause of acute abdomen in these two age groups were incarcerated/strangulated hernias (32%) and roundworm intestinal obstruction (28%). 50% of the children with incarcerated inguinal hernias were below 3 months in age. To quote Spitz (15), "Nearly all inguinal hernias in children are indirect and although they are not in themselves emergencies, they have high incidence of incarceration (up to 50%) in the first 3 months of life, thus surgical correction should be undertaken as soon as conveniently possible".

Fifty per cent of the incarcerated/strangulated inguinal hernias were seen in children below 12 months and 58% below 23 months in age. Two peaks were noted, under 12 months and between 24-59 months (42%). Two children, an 11 month old and a 3½ year old were found with gangrenous gut at operation. Jones (4) comments that surgical correction should not be done before 2-3 years for one reason, incarceration/strangulation does not occur and secondly, there is a higher incidence of recurrence after operation in infancy. The findings in this study call for more work in this area in our set up.

Acute intestinal obstruction with roundworms had a peak incidence of 62.5% in the age group 24-59 months. Adoko (16) in a study of the prevalence of Ascaris



lumbricoides in children at the Paediatric Observation Ward (POW) Kenyatta Hospital, found age group 2-5 years to have the highest incidence of infestation of 29.6%. The findings in this study are similar.

Wijesinha (12) and Abila et al (13) have suggested that children have small calibre of gut lumen thus getting easily obstructed with a ball of worms.

Wijesinha also suggested that intestinal spasm produced by irritation of mucosal sensory receptors and inflammation of the gut wall by toxic metabolites of the worms may add to the problem.

Three children (all above 5 years) were found to have volvulus (2 cases) and, volvulus and intussusception in association with roundworms (1 case). The volvulus involved the small bowel and was found to be gangrenous in all of them at operation. Abila et al found that 4 of the 50 children with roundworm intestinal obstruction had volvulus of the small bowel which was gangrenous at operation and to quote them, "The authors have seen cases in which it was quite clear that roundworms were the leading points of intussusception".

Warambo (14) suggested that a worm bolus may act as a 'bulky heavy meal' dragging on a bowel loop that may rotate causing volvulus. Louw (17) suggested that the irritating effect of the worms on the intestine stimulates hyperperistalsis and may be the initiating factor in the production of intussusception and volvulus.

Diagnosis of roundworms intestinal obstruction or volvulus can pose difficulties. The symptoms are those of any other cause of intestinal obstruction and therefore non-specific. The symptoms and signs as were seen in this study are tabulated in Table XII-A and XII-B. History of vomiting worms was obtained in 27%, passing out worms in 18% and that of vomiting and passing out worms in 10% of the children found to have roundworms in their bowel. These findings are similar to those of Abila et al who found history of vomiting worms in 30% and that of passing out worms in 20% of the children with intestinal obstruction due to roundworms. Thus, the Paediatrician cannot rely wholly on the history of passing or vomiting out worms to make a diagnosis and must seek other diagnostic methods. Plain abdominal X-rays will show worms as masses which appear like coiled locks of hair (Medusa locks) due to trapping of intestinal gas between them. When in difficulties, barium meal follow-through study can be employed which will show linear filling defects that follow anatomical configuration of the worm. At times, a central thin thread of barium can be seen outlining the gut of the worms which have ingested it. In this study, plain abdominal X-rays were obtained which demonstrated the presence of worms in 72% of the cases. However, in the remaining 28%, the radiological features were not that clear. These were mainly the children with volvulus as a complication. Warambo (11) in a study of volvulus of the small bowel noted that it was more difficult to make a

clinical diagnosis of volvulus. However, he observed that antero-posterior and lateral X-rays of the abdomen taken with the patient lying down can be diagnostic. The characteristic features are loops of dilated small bowel collected in a circular fashion in the middle of the abdomen, fluid levels and sometimes opacity suggestive of free fluid.

Two children below 24 months in age had blood stained mucoid stools on rectal examination and were thought to have intussusception. At operation they were found to have roundworms with tears in the ileal mucosa. Louw (17) has suggested that the finding of blood on rectal examination or history of passing blood per rectum with roundworms means that there is acute obstruction and is an indication for immediate operation.

Three children had volvulus due to adhesions following previous abdominal surgery and one, a 5 year old had volvulus in association with mesenteric adenitis. Warambo noted that adhesions were the commonest cause of volvulus which were seen in 21.4% of the patients. In this study, 3 of the 7 children found with volvulus at operation had post operative adhesions. The 3 children had gangrenous bowel at operation which was resected out and anastomosis done. Thus, a Paediatrician or a Paediatric Surgeon evaluating a child with intestinal obstruction, who has a history of abdominal surgery or a surgical scar on the

abdomen, should be alert for this complication. The mortality is high if operation is not done early. In this study, volvulus case fatality was 43%. Warambo also noted a high mortality of 32.1% and attributed it to electrolyte imbalance and absorption of toxic material from gangrenous bowel. Electrolytes were not analysed in this study.

#### Age $\geq$ 60 months

Acute appendicitis was the commonest cause of acute abdomen accounting for 56.4% of all causes in this age group and 87% of all cases of acute appendicitis seen in this study. Two children aged 2 and 4 years made up the remaining 13%.

The diagnosis of acute appendicitis is not a simple one for the symptoms are not specific for acute appendicitis only. Other causes of acute abdomen discussed earlier can have similar symptoms. The findings in this study, Table XIII, are similar to those of Graham and co-workers (9). In their study of acute appendicitis in pre-school children, they found that abdominal pain and abdominal tenderness were the most consistent symptom and sign seen in all the patients. However, localisation of abdominal tenderness was more difficult especially in the younger children. Where they were able to localise abdominal tenderness to the right iliac fossa, this was only possible in children above 4 years.

In this study, localisation of abdominal tenderness to the right iliac fossa was possible in 60% of the patients and correlated with finding an inflamed appendix or an appendicular abscess or mass at operation. To note here, is that children in this study were older, 60% were 10 years or more. Other symptoms like vomiting, anorexia and constipation were less frequent and fever was detected in only 33% of the patients. These observations also agree with those of Graham and co-workers who observed that vomiting, nausea, anorexia, fever and constipation were less frequent symptoms.

Early recognition of acute appendicitis is absolutely necessary to avoid the high morbidity associated with it. In this study, 67% of patients had a perforation or formed an abscess at operation, however, there was no mortality and this reflects on the competence of the Paediatric Surgeons. In one retrospective study (6) of 1640 children, aged 6 weeks to 15 years, a mortality of 0.24% was noted. This was attributed to uncontrolled post-operative sepsis among the children who had appendiceal perforation.

Savrin et al (14), in a study of 49 children, who underwent appendicectomy, found that 41% had a free perforation and 59% had an appendiceal abscess. They also noted that those with perforation or appendiceal abscess had longer duration of illness, mean 4.83 days than those without complications, mean 2.06 days. The findings in this

study are similar, Table XIV. Case 1 and 3 reported here illustrate clearly that the difficulty was in early recognition of the symptoms and signs of the disease resulting in delay in diagnosis and therefore delay in seeking surgical consultation.

## CONCLUSION

1. Low suspicion index resulting in delay in making correct diagnosis and therefore longer duration of illness, significantly contributes to morbidity and mortality in children with acute abdomen.
2. Most parents (81% in this study) were motivated to seek medical consultation early for the illness of their children. Therefore, the responsibility of prompt diagnosis and early surgical consultation lies entirely with those consulted.
3. Acute appendicitis is the commonest cause of acute abdomen requiring surgery in children aged 5 years and above. Delay in making correct diagnosis and therefore in operating results in significant morbidity.
4. Intussusception is the commonest cause of acute abdomen in infants and is associated with significant mortality (41.7% of all the deaths in this study). Diagnosis is largely clinical and barium enema studies can be employed where there is doubt to confirm the diagnosis early and therefore seek surgical consultation.
5. Intestinal obstruction due to roundworms is a major cause of morbidity. They predispose to formation of volvulus and intussusception which by them-

selves are associated with significant morbidity. Plain abdominal X-rays are particularly useful and should be utilised early when diagnosis is suspected.

6. Umbilical hernias can present with incarceration/strangulation as early as the first year of life.



## RECOMMENDATIONS

1. A rotation in the PSU by the Paediatric Residents even as short as 4 weeks, should be considered in the M.Med training programme. This would improve their diagnostic skills and therefore be better equipped Paediatricians in *their various areas of work.*
  
2. The design of this study could not look at each of the causes of acute abdomen in detail. There is therefore a need to undertake studies in the following areas:-
  - a) Intussusception
    - what is the incidence locally?
    - any aetiological factors?
    - is there any seasonal variation?
    - how often is diarrhoea seen in infants with intussusception?
  
  - b) Acute appendicitis
    - incidence of acute appendicitis locally in the Paediatric age group
    - what is the role of diagnostic radiology in the diagnosis of acute appendicitis?

c) Umbilical hernias

- how often do they incarcerate?
- how useful is measurement of neck size in determining whether spontaneous closure will occur and what is the time period for this locally?

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APPENDIX

QUESTIONNAIRE CLINICAL PRESENTATION OF ACUTE ABDOMEN

1. Study No.....Name ..... Age ... Sex ...
  
2. Duration of illness ..... Mode of onset:  
Acute .....  
Gradual .....
  
3. Pain: duration ....., generalised .....  
localised ..... site .....  
continous ..... intermittent .....
  
4. Crying: duration ..... Normal ..... Excessive .....
  
5. Refusal to feed Yes ..... No ..... duration .....
  
6. Vomiting: duration ..... projectile .....  
non-projectile .....  
vomitus: bile ..... blood: fresh ... old ....  
fecal ..... worms .....
  
7. Abdominal distension: duration ..... generalised .....  
localised ..... site .....
  
8. Bowels: regular ,Yes ... No ... when last opened .....  
constipation ,... duration .....  
stools: Normal ..... Diarrhoea .....  
passing worms .....  
passing blood/mucus .....

9. Treatment sought before admission to P.S.U.

Yes ..... No .....

If Yes: what day of illness .....

where .....

sent home on treatment:.....

admitted for treatment .....

surgical consultation sought .....

If sent home on treatment, indicate subsequent

visits .....

and what done .....

.....

.....

If admitted for treatment:

how long .....

when surgical consultation sought .....

If No: what reason(s) for not seeking medical care

early .....

.....

.....

.....

Other information:.....

.....

.....

.....

10. Past medical history: treated for worms in past .....

diabetic .....

sickler .....

previous abdominal surgery .....

when ..... why .....

.....



11. Physical examination:

Paler ..... Fever ..... °C  
 Pulse: Normal ..... Rapid .....  
 Dehydration: Mild ..... Mod. .... Severe .....  
 Abdomen: distended ..... Localised .... Site .....  
 Generalised .....  
 Surgical scar .....  
 Tenderness - generalised ..... localised ....  
 site ..... rigidity .....  
 mass ..... where .....  
 Bowel sounds: Normal ..... reduced .....  
 Increased .....  
 Rectal exam: findings .....  
 .....  
 .....  
 Urinalysis ..... Urea/Electrolytes .....  
 (if done)

12. X-ray abdomen findings .....  
 .....

13. Possible clinical diagnosis .....  
 .....

14. Management: Conservative .....  
 Operation .....  
 if operated on, how long after admission .....  
 .....

15. Operative findings .....

.....

.....

.....

.....

.....

.....

16. Outcome: recovered .....

died .....

after how long .....

.....