

## Assessment of the Correlation between Age of Commencement of Cereal Feeds and Childhood Intussusception

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### ABSTRACT

#### **BACKGROUND**

Early commencement of cereal feeds in a functionally immature gut of an infant may be a risk factor for intussusception. The aim of this study was to evaluate the relationship between time of weaning (commencement of cereals) and onset of intussusception.

#### **MATERIALS AND METHOD**

This was a retrospective study of children treated for intussusception at the pediatric surgery unit of a teaching hospital in Enugu, Nigeria. Children who started cereals before 3 months of age were categorized as group A while child who started cereals after 3 months of age were categorized as group B.

#### **RESULT**

There were 42 cases of intussusception treated during the study period with 28 patients in group A and 14 patients in group B. There was no significant difference in the demographic characteristics, clinical features, operation performed, morbidity and mortality of the 2 groups of patients. However, relating the age at commencement of cereals to the number of children with intussusception gave a p value of 0.003 which is statistically significant.

#### **CONCLUSION**

Early commencement of cereal feeds in infants who are less than 3 months of age may be at risk of intussusception.

#### **KEYWORDS**

Correlation; Cereal feeds; Childhood; Intussusception, Three months

#### **INTRODUCTION**

Intussusception occurs when a bowel segment invaginates into another and a common cause of intestinal obstruction

in infants and young children [1]. Intussusception is a significant cause of pediatric abdominal surgical emergency, bowel gangrene and death can result if left

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untreated [2]. Globally, the reported incidence of intussusception is 0.3 cases to 2.5 cases per 1000 live birth [3]. Children with intussusception generally present with colicky abdominal pain, vomiting, abdominal mass and passage of red currant jelly stool. Late presentation, high morbidity and high mortality of intussusception have been reported in developing countries [3]. Researchers have observed an association between intussusception and virus infection of the respiratory and gastrointestinal tract [4]. One study evaluated the relationship between food allergy and intussusception in children: The food allergy was evidenced by increased serum immunoglobulin-E [5]. There may be a relationship between breastfeeding, introduction of infant cereals and intussusception.

Some previous studies have suggested an association between cereal feeding of infants and intussusception, while other studies found association between breastfeeding and intussusception. The aim of this study was to evaluate the relationship between time of weaning (cereal introduction) and onset of intussusception.

## **MATERIALS AND METHOD**

This was a retrospective study of children aged 12 months and below who presented with intussusception between January 2018 and December 201 at the pediatric surgery unit of Enugu State University Teaching Hospital (ESUTH) Enugu, Nigeria. Diagnosis of intussusception was based on clinical features and confirmed by ultrasound findings of pseudo kidney and target signs. ESUTH is a tertiary hospital located in Enugu, South East Nigeria. The hospital serves the whole of Enugu State, which according to the 2016 estimates of the National population commission and Nigerian national bureau of statistics, has a population of about 4 million people and a population density of 616.0/km<sup>2</sup>. The hospital also receives referrals from its neighboring states. Patients who have had laparotomy for intussusception at a peripheral hospital before referral to ESUTH for reoperation were excluded from this study. Patients with incomplete

medical records and those older than 12 months of age were also excluded from the study. Ethical approval was obtained from the Research Ethics committee of ESUTH and patients' caregivers gave consent for the study. This study followed the principle of Declaration of Helsinki.

### ***Preoperative Preparation***

Children, who presented during the study period, with clinical features and ultrasound confirmation of intussusception, were recruited into the study. All the patients were resuscitated using intravenous fluids and antibiotics. A nasogastric tube and urethral catheter were passed to decompress the upper gastrointestinal tract and monitor urine output respectively. Blood samples were collected for full blood count and serum electrolytes, urea and creatinine. Blood was grouped and cross matched for surgery. Correction of electrolyte derangements was also performed. The procedure was explained to the parents and informed consent obtained.

Cereals refer to meals made from any of the following: Corn, wheat, oats, rice or barley. Inquiries were made from the parents/caregivers about the age of the infant at which cereal feeds was commenced. The age of the child at the onset of symptoms of intussusception was also noted. Children who started cereals before 3 months of age was categorized as group A while children who commenced cereals after 3 months of age were categorized as group B.

### ***Intra-operative Protocol***

Children who had no features of peritonitis at presentation were treated by hydrostatic reduction using normal saline. Children with marked abdominal distension or features of peritonitis had laparotomy through a transverse supraumbilical incision. Manual reduction of intussusception was performed for viable bowel while bowel resection was performed for irreducible or gangrenous intussusception.

**Post-operative Protocol**

The patients were placed on intravenous fluids, antibiotics and analgesics. Oral intake was started when the bowel function returned. Criteria for discharge were based on adequate wound healing, full mobilization and good oral intake.

**Data collection and analysis**

Data were collected in a proforma which included the age at presentation, gender, age at commencement of cereals, age at diagnosis of intussusception, duration of symptoms before presentation, treatment offered, post-operative complications, duration of hospital stay and outcome of treatment.

Statistical Package for Social Science (SPSS) version 23, manufactured by IBM, Cooperation Chicago, Illinois, was used for data entry and analysis. Data were expressed as percentage, mean, median, standard deviation. Chi square or student’s T test was used to test for significance. P value <0.05 was considered statistically significant.

**RESULTS**

**Patients’ Demographics**

There were 45 children with intussusception treated during the study period but only 42 patients had complete medical records and formed the basis of this report. There were 28 patients in group A and 14 patients in group B. Detail of the demographics is shown in Table 1.

Gender	Group A	Group B
Male	15 (53.6%)	8 (57.1%)
Female	13 (46.4%)	6 (42.9%)
Duration of Symptoms	3 days (1 - 5)	3 days (1 - 4)
Presented within 24 hours	4 (14.2%)	1 (7.1%)
Presented between 24 hours and 48 hours	5 (17.9%)	2 (14.3%)
Presented after 48 hours	19 (67.9%)	11 (78.6%)
Interval from Presentation to Treatment	1.3 days (Range: 1-3)	1.4 days (Range: 1-3)
Mean duration of Hospitalization	11 days (Range 7 -18)	10 days (Range: 6-19)

**Table 1:** Demographic characteristics of the 2 groups of patients.

	Group A		Group B		p value
	Mean	SD <sup>a</sup>	Mean	SD	
Mean age (months)					
At Start of Cereal	2.8	1.22	6.0	0.88	
At Diagnosis of Intussusception	5	1.12	10	0.72	0.003*

**Table 2:** Mean ages at commencement of cereals and at diagnosis.

Note: <sup>a</sup>SD = Standard deviation; \*Statistically Significant.

Presenting Symptoms	Group A (%)	Group B (%)
Abdominal pain + vomiting + red currant stool	13 (46.4)	7 (50.0)
Abdominal pain + fever + red currant jelly	9 (32.2)	3 (21.4)
Red currant jelly + fever + vomiting + distension	3 (10.7)	2 (14.3)
Abdominal pain + vomiting + distension + red currant stool	3 (10.7)	2 (14.3)
Total	28 (100)	14 (100)

**Table 3:** Symptomatology of the patients.

**Age at Commencement of Cereals and Age at Diagnosis**

The mean age at which cereals was started and age at diagnosis of intussusception are depicted in Table 2.

**Presenting Symptoms**

The patients presented with abdominal pain, vomiting, fever, abdominal distension and passage of red currant stool in various combinations. Abdominal pain was the

most common presenting symptom in the patients (Table 3).

### **Investigations Performed**

All the patients had an abdominal ultrasound for the diagnosis of the intussusception. Six (21.4%) patients in group A had a plain abdominal x ray while 4 (28.6%) patients in group B had an abdominal x ray. None of the patients had a computed tomography (CT) scan.

### **Treatment offered**

All the patients had ileocolic intussusception. Treatments received by the patients are depicted in Table 4.

<b>Treatment Received</b>	<b>Group A (%)</b>	<b>Group B (%)</b>
Hydrostatic Reduction	9 (32.1)	4 (28.6)
Manual Reduction	9 (32.1)	5 (35.7)
RHC + ITA	10 (35.8)	5 (35.7)
Total	28 (100)	14 (100)

**Table 4:** Intra-operative finding and treatment.

**Note:** RHC = Right Hemicolectomy; ITA = Ileotransverse Anastomosis

### **Post-operative Complications**

Majority of the patients in both groups did not develop any complications. Four (14.3%) patients in group A and 2 (14.3%) patients in group B had surgical site infection while one patient in each group developed incisional hernia.

### **Outcome**

Twenty-six (92.9%) patients in group A and 12 (85.7%) patients in group B recovered fully and were discharged home. Two patients in group A (7.1%) and one patient in group B (7.1%) expired. The cause of death was overwhelming sepsis.

## **DISCUSSION**

Several factors, including the recent history of gastroenteritis, certain age groups and low socioeconomic class have been associated with increased risk of pediatric intussusception [6]. Intussusception may be associated with significant morbidity and mortality, hence, the need to avoid the factors that may predispose a child to

intussusception. For instance, Rotavirus vaccination prevents gastroenteritis although there are reports of low risk of intussusception associated with rotavirus vaccination [7].

In the present study, there is a male predominance in the 2 groups of patients. This finding is in agreement with the report of other authors [8,9]. However, one series on intussusception reported female predominance [10]. The reason for the gender disparity is not known. The peak age of our patients is consistent with the report of Huppertz et al. [11]. It is important to note that intussusception can occur at any age [12]. About two-thirds of our patients presented more than 48 hours after onset of their symptoms. This late presentation may be due to poverty and lack of awareness on the part of the parents. The mean interval of one day from presentation to treatment was the time required to investigate, resuscitate, optimize and provide materials required for surgery. Absence of well-established health insurance scheme, paucity of funds and late presentation prolong optimization of these patients. The duration of hospitalization of our patients is similar to the report of one study from Tanzania [13]. However, there is no significant difference in the duration of hospital stay of the group A and group B patients. The duration of hospitalization of children treated for intussusception may depend on the modality of treatment. For instance, patients treated by hydrostatic reduction are discharged earlier than patients that had laparotomy.

World Health Organization and American Academy of pediatrics recommend exclusive breastfeeding for the first 6 months of the baby's life for optimal growth and development [14]. The digestive system of infants less than 4 months of age cannot process cereals properly due to structural and functional immaturity of the gut [15]. Cereals are commenced in infants during the process of weaning and there are reasons why parents are tempted to start cereals early. These reasons include worries that the baby is not getting enough breast milk/formula and rumors

that cereals make the baby sleep better. In the current study, there were more intussusceptions in infants who started cereals before 3 months of age (group A) and this was found to be statistically significant. Other researchers have reported the increased occurrence of intussusception following early introduction of cereals and solid food [16]. The pathogenesis of intussusception following early cereal introduction may be due to allergy to the cereals or the introduction of viruses such as rotavirus and adenovirus into the gastrointestinal tract [5,17]. The impact of diet in intussusception has been elucidated by other authors. Masilamani et al. reported successful treatment of recurrent intussusception in a female infant through dietary restriction [18]. The role of breastfeeding in the etiology of intussusception has remained controversial. Pisacane et al. reported that exclusive breastfeeding is risk factor for intussusception while Oberle et al. reported that breastfeeding is protective [17,19]. The reason for these differences in findings is not clear.

Abdominal pain was the most common symptom in the current series. Other authors also reported abdominal pain as the most common symptom [20,21]. However, painless intussusception can occur in infants who are less than 4 months of age [22]. Vomiting or abdominal distension may be the most common symptom of intussusception [13,23]. Time of presentation of the patients to the hospital may determine the prevalent symptom. The classic triad consisting of abdominal pain, vomiting and passage of red currant jelly stool was present in about half of the patients in the 2 groups. Chalya et al. also had a similar report [13]. There was no significant difference in symptoms between group A and group B patients.

Ultrasound has been described as imaging modality of choice for diagnosing intussusception in children because of its high sensitivity and specificity [24]. One hundred percent of the patients in the current study had an abdominal ultrasound and all the intussusceptions were detected at ultrasound. Accuracy of ultrasound in

detecting intussusception may be affected by massive gaseous bowel distension [25]. Abdominal radiograph may show features of intestinal obstruction such as air-fluid levels and dilated bowel loops which are not specific for intussusception. CT scan was not performed in any of the patients due to its non-affordability, non-availability and high risk of radiation exposure.

Majority of the patients in the 2 groups had right hemicolectomy with ileotransverse anastomosis. The indications for right hemicolectomy included bowel gangrene and irreducible intussusception. Late presentation of the patients may explain the high number of bowel resections performed in the index study. Children who present early with intussusception benefit from non-operative treatment (hydrostatic reduction) which is less invasive, painless, cheap and causes less physiologic disruptions.

Surgical site infection was the most common complication in the 2 groups of patients. This finding is in line with the report of other authors [13,26]. The incidence of wound infection is higher in patients who present late and underwent bowel resection [1]. Exposure of the wound to gut bacteria during bowel resection may explain the surgical site infection.

Mortality following treatment for intussusception in children varies widely [27]. Mortality following treatment of intussusception may depend on the time of presentation, modality of treatment and post-operative complications.

## **CONCLUSION**

Early commencement of cereal feeds in infants, who are less than 3 months of age, may be a risk factor for intussusception. It is recommended that parents/caregivers should wait for their infant to achieve 6 months of age before cereals are started.

### ***Limitations of the Study***

1. This study was limited by the small number of cases.
2. Other variables such as preceding viral infections of the respiratory or gastrointestinal tract before onset of the intussusception were not evaluated.

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