**Intestinal Resection in Children: Our Experience in Enugu, Nigeria**

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Running title: Intestinal Resection in Children

**Abstract**

Background: Intestinal resection in children is an important surgical procedure because of the possible complications that may arise from it. Late presentation and ignorance in developing countries have made intestinal resection a frequent surgical procedure. Methods: This was a retrospective study of children that had intestinal resection in the pediatric surgery unit of Enugu State University Hospital, Enugu, Nigeria. Medical records of pediatric patients that had intestinal resection over a 10-year period were evaluated for the indications. Other parameters assessed included patients’ demography, duration of symptoms before presentation, time interval between presentation and intervention, complications arising from the intestinal resection, and outcome. Results: There were 52 cases of intestinal resections with an age range of 1-168 months (median 10 months) and male to female ratio of 2.25:1. There were 9 neonates, 29 infants and 14 children (older than 1 year). The indications for intestinal resection were gangrenous/irreducible intussusception 28 (53.8%), strangulated external hernia 7 (13.5%), typhoid intestinal perforation 6 (11.5%), intestinal atresia 3 (5.8%), gastroschisis 3 (5.8%), abdominal trauma 2 (3.8%), and midgut volvulus 3 (5.8%). The following definitive surgical procedures were done: Right hemicolectomies with ileotransverse anastomosis 28 (53.8%), segmental resection with end to end anastomosis 20 (38.5%), and massive intestinal resection with end to end anastomosis 4 (7.7%). The median duration of symptoms prior to presentation and median duration from presentation to surgery were 3 days and 2 days respectively. The mean duration of hospital stay was 15 days. Twenty patients (38.4%) developed complications which included surgical site infection 8 (15.4%), enterocutanous fistula 6 (11.5%), intra-peritoneal abscess 4 (7.7%) and adhesive intestinal obstruction 2 (3.8%). There were eight deaths accounting for 15.4% of the patients. Conclusion: Intestinal resection was mostly done for intussusception in the present study. Late presentation and ignorance contributed significantly to the number of intestinal resection done.

**Keywords:** Children, intestinal resection, experience, intussusception, hernia.

**1. Introduction**

The pediatric surgeon in carrying out his duties undertakes intestinal resection in children as part of the treatment of his patients. There are wide range of indications for intestinal resection and these indications range from congenital to acquired anomalies. In a resource poor setting like ours, the indications for intestinal resection are mostly for acquired and preventable disease conditions. However, publications from high income countries reported that surgeries for congenital anomalies were the most common indications for intestinal resection [1, 2, 3]. There has not been any published report of intestinal resection in children from our centre. In this study, we reviewed our experience with intestinal resection in children over a 10-year period at Enugu State University Teaching Hospital (ESUTH), Enugu, Nigeria. We evaluated the indications, complications and outcomes of pediatric intestinal resection. This study will help to identify the challenges encountered in the management of these patients and proffer possible solutions.

**2. Methodology**

This was a retrospective study of children aged 15 years and below who had intestinal resection procedure between September 2008 and October 2018 at the pediatric surgery unit of ESUTH Enugu, Nigeria. Patients who have had intestinal resection for the same pathology at a peripheral hospital before referral to ESUTH for reoperation were excluded from this study. 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/km2. The hospital also receives referrals from its neighboring states. Information was extracted from the case notes, operation notes, operation register, and admission-discharge records. The information extracted include the age, gender, duration of symptoms before presentation, time interval between presentation and intervention, indication for intestinal resection, definitive operative procedure done, complications, duration of hospital stay and outcome of treatment. The period of follow up was for 6 months. Ethical approval was obtained from the ethics and research committee of ESUTH.Statistical Package for Social Science (SPSS) version 21 was used for data entry and analysis. Data were expressed as percentages, median, mean, and range.

**3. Results**

**3.1. Patients’ demography**

Sixty two intestinal resections were done during the study period but only 52 cases had complete case records and formed the basis of this report. There were 36 males (69.2%) and 16 females (30.8%), with a male to female ratio of 2.25:1. The ages of the patients ranged from 1 to 168 months, with a median of 10 months. Sixty five percent of the patients were less than 12 months of age. The median duration of symptoms prior to presentation to the hospital was 3 days (1 – 5). Seven patients (13.5%) presented within 24 hours of onset of symptoms while eleven patients (21.2%) presented between 24 and 48 hours. Thirty four patients (65.3%) presented after 48 hours of onset of their symptoms. The median duration from presentation to surgery was 2 days (range: 1 - 4). Most of the patients (69.3%) were operated on within 48 hours of presentation to the hospital. The mean duration of hospital stay was 15 days, as shown in Table 1.

Table 1: Demographic characteristics of the patients

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| --- |
| Gender  Male 36 (69.2%)  Female 16 (30.8%) |
| Median age of the patients 10 months (1-168) |
| Median duration of symptoms prior to presentation 3 days (1 – 5)  Presented within 24 hours 7 (13.5%)  Presented between 24 and 48 hours 11 (21.2%)  Presented after 48 hours 34 (65.3%) |
| Median duration from presentation to surgery 2 days (1 - 4)  Within 24 hours 7 patients (13.5%)  Between 24 and 48 hours 29 patients (55.8%)  After 48 hours 16 patients (30.7%) |
| The mean duration of hospital stay 15 days |

**3.2. Indications and age distribution of the patients**

The various indications for intestinal resection and their corresponding age distributions are shown in Table 2.

Table 2: Indications and age distribution

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| --- |
| Age groups  Disease condition Neonates (%) Infants (%) Children >1 year Total (%) |
| Intussusception - 28 (96.6) - 28 (53.8)  Strangulated hernia - 1 (3.4) 6 (42.9) 7 (13.5)  Intestinal atresia 3 (33.3) - - 3 (5.8)  TIP - - 6 (42.9) 6 (11.5)  Gastroschisis 3 (33.3) - - 3 (5.8)  Trauma - - 2 (14.2) 2 (3.8)  Midgut volvulus 3 (33.3) - - 3 (5.8)  Total (%) 9 (100) 29 (100) 14 (100) 52 (100) |

TIP=Typhoid intestinal perforation

**3.3. Definitive operation performed**

Right hemicolectomy with ileotransverse anastomosis was the most common performed definitive surgical operation 28 (53.8%), segmental resection with end to end anastomosis 20 (38.5%), massive intestinal resection with end to end anastomosis 4 (7.7%). Details are shown in Table 3.

Table 3: Diagnosis and definitive surgical procedure

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| --- |
| Diagnosis Surgical treatment Number (%) |
| Intussusception Right hemicolectomy with ITA 28 (53.8)  Strangulated hernia Segmented resection and anastomosis 7 (13.5)  TIP Segmented resection and anastomosis 6 (11.6)  Intestinal atresia Segmented resection and anastomosis 3 (5.8)  Trauma Segmented resection and anastomosis 2 (3.8)  Gastroschisis Massive bowel resection 3 (5.8)  Midgut volvulus Segmented resection and anastomosis 2 (3.8)  Midgut volvulus Massive bowel resection 1 (1.9) |

ITA=Ileotransverse anastomosis, TIP=Typhoid intestinal perforation

**3.4. Complications following intestinal resection**

Majority of the patients (61.6%) did not develop any complications. Eight patients (15.4%) developed surgical site infection. Other complications are shown in Table 4.

Table 4: Complications

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| --- |
| Complication Neonate Infants Older than 1 year Total (%) |
| SSI 4 2 2 8 (15.4)  ECF - 2 4 6 (11.5)  Intra-peritoneal abscess - 2 2 4 (7.7)  AIO - - 2 2 (3.8) |
| SSI=Surgical site infection, ECF=Enterocutanous fistula, AIO=Adhesive intestinal obstruction |

**3.5. Outcome**

Forty two patients (80.8%) did well and were discharged home. Two patients (3.8%) signed against medical advice in the post-operative period. Mortality was recorded in 8 patients (15.4%). Mortality occurred most amongst the neonates.

**4. Discussion**

Acquired and preventable disease conditions account for the majority of the intestinal resections in children in developing countries [4]. Possible morbidity and mortality associated with intestinal resection make intestinal resection an important surgical procedure [1]. Massive intestinal resection may result in short bowel syndrome when the functioning gut mass is reduced below the amount necessary for adequate digestion and absorption of fluid and nutrients [5].

The male dominance reported in the current study is consistently observed in other studies too [1, 3, 4, 6]. The median age of our patients of 10 months is similar to the reports of Ezomike et al and Ajao et al [4, 5]. However, a study done in northern Nigeria reported a median age of 6 years. The differences in the median ages of the patients may be explained by the geographical area of the study where different disease conditions are predominant. For instance, Ameh reported typhoid intestinal perforation as the most common indication for intestinal resection while in the present study we recorded intussusception as the most common indication. Late presentation of our patients is manifested in the median duration of 3 days prior to presentation to the hospital. This finding is consistent with the report of other series [4, 6]. It is noteworthy that this late presentation is common in developing countries which may due to poverty and ignorance [7]. Early presentation reduces the rate of intestinal resection [8]. In developed countries, majority of the children are hospitalized within 24 hours of onset of symptoms [9, 10]. Average time to intervention of 48 hours reported in the current study is in agreement with the report of Ezomike et al [4]. The length of hospitalization of our patients is in line with the result from previous studies [3, 4]. However, Ameh reported a longer duration of hospital stay in his patients. Chalya et al in their study of childhood intussusception reported that the length of hospital stay was long in children who had intestinal resection [11].

In the present study, intussusception was the most common indication for intestinal resection in our patients. This finding is in accordance with the result of previous studies [3, 4, 6, 12, 13]. But, it is at variance with a report from Zaria, Nigeria which reported typhoid intestinal perforation as the most common indication for intestinal resection [1]. The reason for this variation is not exactly known but may be explained by place of study and the prevalent disease pattern. The low incidence of typhoid intestinal perforation as an indication for bowel resection in the current study may reflect the reduced incidence of typhoid fever in the area of study [14].

Majority of our patients had right hemicolectomy with ileotransverse anastomosis. This finding is supported by the reports of other studies [4, 6]. However, a study reported segmental ileal resection as the most common surgical procedure done on the patients [1]. Studies done in northern Nigeria have shown segmental ileal resection as the most effective treatment modality for typhoid ileal perforation [15, 16]. Definitive surgical treatment offered to the patients who undergo intestinal resection depends on disease condition of the patients. All the 4 of our patients that received massive bowel resection had extensive bowel gangrene secondary to gastroschisis. Our complication rate is comparable to the results of other studies of its nature [4, 6]. Complication rate following intestinal resection can be as low as 26% [1]. Post-operative complication rates varies widely and occurrence of surgical site infection involves complex interaction among several factors such as microbial, patient, surgical, environmental, healthcare facility and procedure performed [17, 18]. The mortality rate in the current study appears to be the average of what other researchers recorded; published mortality ranges from 5.5% to 31.8% [1, 4, 6].

**5**. Conclusion

In the present study, gangrenous/irreducible intussusception was the most common indication for intestinal resection. Early presentation and awareness of the clinical conditions by the parents and medical practitioner may have prevented some of these intestinal resections.

**Authors’ contribution**: The author contributed solely to this article

**Availability of data and materials**: Data is available with the author and can be provided on request.

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**Consent for publication**: Not applicable

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