

## Laparotomy in Children in a Tertiary Hospital in a Developing Country: Indications, Complications and Outcome

Chukwubuike Kevin Emeka<sup>1\*</sup>, Nduagubam Obinna Chukwuebuka<sup>2</sup>, and Chime Onyinye Hope<sup>3</sup>

<sup>1</sup>*Pediatric Surgery Unit, Department of Surgery, Enugu State University Teaching Hospital, Enugu, Nigeria*

<sup>2</sup>*Department of Paediatrics, Enugu State University Teaching Hospital, Enugu, Nigeria*

<sup>3</sup>*Department of Community Medicine, Enugu State University Teaching Hospital, Enugu, Nigeria*

Correspondence should be addressed to Chukwubuike Kevin Emeka, Department of Surgery, Enugu State University Teaching Hospital, Enugu, Nigeria

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### ABSTRACT

#### **BACKGROUND**

Pediatric laparotomy is important surgical procedure necessary for the diagnosis and treatment of abdominal surgical conditions in children. The objective of this study was to evaluate our experience on pediatric laparotomy in terms of indications, complications and outcome.

#### **METHODOLOGY**

This was a retrospective study of children aged 15 years and younger who had laparotomy (for various indications) between January 2017 and December 2018 at the pediatric surgery unit of Enugu State University Teaching Hospital (ESUTH) Enugu, Nigeria.

#### **RESULTS**

A total of 202 pediatric laparotomies were performed during the study period. There was male predominance and the median age of the patients was 5 years. Majority of the patients were infants and most of the laparotomies were performed as emergency surgeries. The mean duration of hospital stay of the patients was 10 days and abdominal pain was the most common symptom. At presentation, one-half and one-quarter of the patients had low hemoglobin and electrolyte derangement respectively. Abdominal ultrasound and x rays were diagnostic in about 50% of the patients. Intussusception was the most common indication for laparotomy and surgical site infection was the most common post-operative complication. Eleven (5.4%) patients expired.

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## **CONCLUSION**

Laparotomy in children can be lifesaving and infants with intussusception were the largest group of patients in the current series. Abdominal pain, anemia and electrolyte derangement were the common indices at presentation. Pediatric laparotomy can be associated with morbidity and mortality.

## **KEYWORDS**

Children; Complications; Developing country; Indications; Outcome

## **INTRODUCTION**

Laparotomy, also known as celiotomy, is a surgical procedure that involves making incision through the anterior abdominal wall to gain access into the abdominal cavity. Historically, in 1809, Ephraim McDowell performed the first successful laparotomy without anesthesia. In 1881, George Goodfellow treated gunshot to the abdomen through a laparotomy [1]. Laparotomy may be classified into diagnostic laparotomy or therapeutic laparotomy. In diagnostic laparotomy, which is also known as exploratory laparotomy, the nature of the pathology is not known and laparotomy is required to confirm the pathology. In therapeutic laparotomy, the pathology has been identified and laparotomy is required for the treatment of the pathology. Exploratory laparotomy may continue as a therapeutic procedure [2]. In children, the indications for laparotomy ranges from congenital to acquired anomalies. The congenital anomalies that require laparotomy include intestinal atresia while acquired anomalies such as intussusception is also treated via laparotomy. Other indications for laparotomy in children include severe abdominal trauma, abdominal malignancy and gastrointestinal bleeding [3]. Although laparotomy is lifesaving, complications may occur and the outcome in low-income countries is still far from what is obtainable from developed countries [4]. There is paucity of data on pediatric laparotomy in Nigeria, hence, the need for this study. The objective of this study was to evaluate our experience on pediatric laparotomy in terms of indications, complications and outcome.

## **MATERIALS AND METHODS**

This was a retrospective study of children aged 15 years and younger who had laparotomy (for various indications) between January 2017 and December 2018 at the pediatric surgery unit of Enugu State University Teaching Hospital (ESUTH) Enugu, Nigeria. 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 at a peripheral hospital before referral to ESUTH for reoperation were not excluded from the study. Patients with incomplete medical records and those older than 15 years of age were excluded. Information was extracted from case notes, operation notes, operation register, and admission-discharge records. The information extracted included age, gender, nature of the laparotomy, interval between onset of symptoms and presentation, interval between presentation and laparotomy, presenting symptoms, investigations performed, intra-operative finding, operative procedure performed, post laparotomy complications, duration of hospital stay and outcome of treatment. All the laparotomies were performed by a consultant pediatric surgeon. Ethical approval was obtained from the ethics and research committee of ESUTH. Statistical Package for Social Science (SPSS) version 21, manufactured by IBM Cooperation Chicago

Illinois, was used for data entry and analysis. Data were expressed as percentage, median, mean and range.

**RESULTS**

***Patient’s Demographics***

A total of 217 pediatric laparotomies were performed during the study period but only 202 cases had complete record and formed the basis of this report. Details of the demographics are shown in Table 1.

| <b>Gender</b>                                    |                                     |
|--|-------------------------------------|
| Male   | 141 (69.8)                          |
| Female   | 61 (30.2%)                          |
| Age range  | 7 days to 14 years (median 5 years) |
| <b>Age groups</b>                                |                                     |
| Neonates (< 1 month)                             | 21 (10.4%)                          |
| Infants (1-12 months)                            | 108 (53.5%)                         |
| 12 months to 15 years                            | 73 (36.1%)                          |
| <b>Nature of the laparotomy</b>                  |                                     |
| Emergency  | 171 (84.7%)                         |
| Elective   | 31 (15.3%)                          |
| Mean interval from symptom onset to presentation | 5 days (2-14 days)                  |
| Median interval from presentation to laparotomy  | 2 days (1-4 days)                   |
| Mean duration of hospital stay                   | 10.2 days (range 7-18)              |

**Table 1:** Demographic profile of the patients.

***Presenting Symptoms***

Abdominal pain was the most common symptom in the patients. Other symptoms are shown in Table 2.

| Presenting symptoms   | Number of patients (%) |
|-----------------------|------------------------|
| Abdominal pain        | 177 (87.6)             |
| Vomiting              | 151 (74.8)             |
| Constipation          | 98 (48.5)              |
| Abdominal distension  | 53 (26.2)              |
| Non-specific symptoms | 12 (5.9)               |

**Table 2:** Presenting symptoms of the patients.

***Investigations***

***Hematological and biochemical***

Ninety-eight (48.5%) patients had a hemoglobin level of less than 10 grams per deciliter (g/dl) whereas 57 (28.2%) patients had electrolyte derangements.

***Imaging***

All the patients had plain abdominal radiograph and abdominal ultrasound. Abdominal radiographs were diagnostic in 95 (47.0%) patients whereas ultrasound was diagnostic in 121 (60%) patients. Computed tomography (CT) scan was performed in 17 (8.4%) patients. Magnetic resonance imaging (MRI) was not performed in any of the patients because of non-availability. Upper gastrointestinal contrast study was done in 15 (7.4%) patients while 13 (6.4%) patients had barium enema.

Intra-operative findings (indications) and operative procedure performed.

The intra-operative findings and definitive operations performed are shown in Table 3.

| Operative finding               | Number of patients (%) | Operative procedure     |
|---------------------------------|------------------------|-------------------------|
| Intussusception                 | 97(48.0)               |                         |
| Non-viable bowel                | 65(32.2)               | RHC + ITA               |
| Viable bowel                    | 32(15.8)               | Manual reduction        |
| Typhoid intestinal perforation  | 55(27.2)               | Closure of perforation  |
| Ruptured appendix               | 11(5.4)                | Appendectomy + drainage |
| Adhesive intestinal obstruction | 11(5.4)                | Adhesiolysis            |
| Intestinal atresia              | 7(3.5)                 | Resection + anastomosis |
| Ruptured omphalocele            | 7(3.5)                 | Closure + repair        |
| Gastroschisis                   | 6(3)                   | Closure + repair        |
| Ruptured spleen                 | 6(3)                   | Splenectomy             |
| Strangulated external hernia    | 2 (1)                  | Resection + anastomosis |

### ***Post laparotomy complications***

One hundred and eighty-one (89.6%) patients did not have any complications. Twenty-one (10.4%) patients developed at least one complication: Surgical site infection 10 (5%); enterocutaneous fistula resulting from anastomotic leak 4 (2%); adhesive intestinal obstruction 3 (1.5%); incisional hernia 2 (1%); burst abdomen 2 (1%).

### ***Outcome of treatment***

One hundred and ninety-one (94.6%) patients made a full recovery and were discharged home. Eleven (5.4%) patients expired. Ten out of the 11 patients that died were neonates. The cause of death was overwhelming sepsis. One infant died from respiratory failure secondary to aspiration pneumonitis

## **DISCUSSION**

Surgical needs of children are fundamentally different from those of adults. Congenital anomalies and surgical conditions resulting from infective processes form a large portion of the overall surgical burden in children [5,6]. Acute abdominal conditions in children may be caused by a variety of pathological conditions that require surgical management. The pathological conditions affecting the gastrointestinal tract may be in the form of intestinal obstruction or perforation peritonitis [7].

In the present study, there was male predominance. This finding is consistent with the report of other authors [8,9]. The reason for the gender difference is not known. The age range of our patients is at variance with the report of Ghritiaharey et al. [8] The age at pediatric laparotomy varies widely and may depend on the pathology involved. For instance, intussusception is more likely to occur in infants while typhoid intestinal perforation is more likely to occur in older children. About 50% of the patients in the current series were infants. However, one study from Pradesh, India reported that majority of their patients who had laparotomy were between 5 years and 12 years of age [8]. The pathological condition, its etiology, time of onset of symptoms and age at presentation of the patients may determine the age at laparotomy. There were more emergency laparotomies than elective laparotomies in the index study. Negussie et al. [10] also reported more emergency laparotomies in their series. The mean period of 5 days before presentation to the hospital may reflect the high level of poverty and ignorance that is prevalent in low-income countries. The mean interval of 2 days between presentation and laparotomy was the time required for investigation and optimization of the patients for surgery. Our patients stayed for an average of 10 days. Following laparotomy, the length of time patients stay in

the hospital may depend on the extent of the operative procedure performed and the post-operative course.

Abdominal pain is a common complaint in children and the challenge lies in differentiating surgical from non-surgical causes [11]. Abdominal pain was the most common symptom of the patients in the current series. Chukwubuike in his series on intussusception also reported abdominal pain as a common presentation in children that required laparotomy [12]. Older children vocalize their abdominal pain while infants may express abdominal pain by drawing the knees to their chest when they cry [13]. The origin of the abdominal pain could be visceral, somatic or referred. Other presenting symptoms may depend on the pathology and time of presentation. For instance, children presenting late with typhoid intestinal perforation may have abdominal distension in addition to abdominal pain. Non-specific symptoms such as weight loss and dyspepsia may be seen in children with intestinal malrotation [14].

About half of our patients had a hemoglobin level of less than 10 g/dl on presentation. The low hemoglobin level may be pre-existing or may have followed the onset of symptoms. Children in low-income countries are prone to anemia due to poor nutritional status and parasitic infestations such as helminthiasis [15]. Sepsis and passage of red currant jelly stool may also explain the low hemoglobin level. Electrolyte derangements such as hyponatremia and hypokalemia were noticed in about one-quarter of our patients. Delayed presentation of the patients with the associated prolonged vomiting and spurious diarrhea may explain the electrolyte derangement. All the patients had abdominal ultrasound and plain abdominal x ray. However, these investigations were only diagnostic in about 50% of the patients. The expertise and experience of the radiologist may determine the ability of the radiologist to detect the offending pathology. Only one-tenth of our patients had a CT scan.

The non-availability, non-affordability and the risk of radiation exposure associated with CT scan accounted for low number of children that had CT scan. A few patients had contrast studies (upper and lower intestinal series). The request for contrast studies was based on findings on clinical evaluation.

In the current study, the most common indication for laparotomy in children was intussusception. One study from North central Nigeria also found intussusception as the most common pediatric abdominal surgical emergency requiring laparotomy [16]. However, Ekenze et al. and Abatanga et al. in their separate studies reported typhoid intestinal perforation as the most common indication for laparotomy [17,18]. This difference in findings may be explained by the difference in the age cohort of children recruited by the different studies. For instance, Abatanga et al. [18] recruited only children who are older than one year of age. The indications for laparotomy in children may vary from place to place and from time to time [19]. The majority of our patients did not develop any complications. Surgical site infection was the most common complication in the current study. Other series also reported surgical site infection as a common complication [20,21]. Enterocutaneous fistula is an unpleasant complication of operations on the gastrointestinal tract. Four (2%) of our patients that developed enterocutaneous fistula were managed non-operatively and the fistula healed on non-operative treatment. Adhesive intestinal obstruction may result from fibrous bands and adhesions formed during the healing process. Technical factors (surgeon's factor) and/or patient's factors may result in inadequate healing culminating into a burst abdomen or incisional hernia.

Majority of our patients survived. Most mortality was among neonates who succumbed to overwhelming sepsis. Ekenze et al. in their series also reported that there was higher mortality in neonates who underwent laparotomy

[17]. Neonates are unique group of individuals that have different features from older children and adults. The fragile homeostasis of neonates may be tipped over by the stress of surgery, anesthesia, and sepsis [21].

### **CONCLUSION**

Laparotomy in children can be lifesaving and infants with intussusception were the largest group of patients that had laparotomy in the current series. Abdominal pain, anemia and electrolyte derangement were the common indices at presentation. Pediatric laparotomy can be associated with

morbidity and mortality. We recommend early presentation, prompt diagnosis and treatment of pediatric abdominal surgical conditions to reduce the sequelae experienced in pediatric laparotomy.

### **SOURCE OF FUNDING**

None

### **CONFLICT OF INTEREST**

None

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