**Peritonitis in Children: Experience in a Developing Country**

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Running title: Peritonitis in Children

**Abstract**

**Background:** Peritonitis may be associated with significant morbidity and mortality. The aim of this study was to evaluate our experience with the management of secondary peritonitis in children. **Methods**: This was a retrospective study of children that had laparotomy for peritonitis in the pediatric surgery unit of Enugu State University Teaching Hospital (ESUTH), Enugu, over a 5-year period. **Results:** There were 52 cases of laparotomies for peritonitis with an age range of 2 weeks to 14 years (median 9 years) and male to female ratio of 3.3:1. The etiologies of peritonitis were typhoid intestinal perforation 25 (48%), ruptured appendix 9 (17.3%), perforated intussusception 8 (15.4%), perforated external hernia 3 (5.8%), perforation due to adhesive intestinal obstruction 3 (5.8%), perforated necrotizing enterocolitis 3 (5.8%) and bowel perforation due to trauma 1 (1.9%). The following definitive surgical procedures were performed: Closure of bowel perforation 26 (50%), appendectomy plus abscess drainage 9 (17.3%), right hemicolectomy with ileotransverse anastomosis 8 (15.4%), segmental bowel resection 6 (11.5%) and insertion of peritoneal drains 3 (5.8%). The median duration of symptoms prior to presentation and median duration from presentation to surgery were 4 days and 2 days respectively. Twenty-four patients (46.2%) developed complications which included surgical site infection 12 (23.1%), enterocutanous fistula 5 (9.6%), intra-abdominal abscess 4 (7.7%) and wound dehiscence 3 (5.8%). There were 7 deaths accounting for 13.5% of the patients. **Conclusion**: Typhoid intestinal perforation was the most common cause of peritonitis in the present study.

**Keywords:** children; peritonitis; developing country; single centre.

**1. Introduction**

Peritonitis could be defined as inflammation of the peritoneum regardless of its etiology and it is one of the major challenges in surgical practice [1]. Other terms synonymously used for peritonitis, but not exactly the same, include intra-abdominal infection or intra-abdominal sepsis [1]. Peritonitis may be caused by perforation of the bowel or hollow viscus such as ruptured appendix. Other causes of peritonitis include anastomotic leak and translocation of bacteria, amongst others [1]. Peritonitis may be classified into primary, secondary and tertiary peritonitis based on the source and nature of the microbial contamination [2]. Peritonitis may also be classified into localized peritonitis or diffuse peritonitis. Historically, Kirschner in 1926 demonstrated that by following strict surgical principles the mortality rate of peritonitis can be reduced from 80% to about 60% [3]. Subsequently, developments of new operative techniques, provision of potent antibiotics and intensive care treatment have reduced the mortality of peritonitis to an average of 30% to 40% [4]. The factors that affect the outcome of peritonitis are patient related, disease related and intervention related [5]. In this study, we reviewed our experience with the management of secondary peritonitis in children over a 5-year period at Enugu State University Teaching Hospital (ESUTH), Enugu, Nigeria. We evaluated the patients’ demographics, presenting symptoms, operative findings, post-operative complications and management outcome of secondary peritonitis in children.

**2. Methodology**

This was a retrospective study of children aged 15 years and below who were managed for peritonitis between January 2014 and December 2018 at the pediatric surgery unit of ESUTH Enugu, Nigeria. Patients who have had surgery for peritonitis at a peripheral hospital before referral to ESUTH for reoperation were excluded from this study. Patients with primary peritonitis were also excluded from the 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 included the age, gender, presenting symptoms, duration of symptoms before presentation, time interval between presentation and intervention, intra-operative finding, definitive operative procedure performed, complications of treatment, duration of hospital stay and outcome of treatment. Diagnosis of peritonitis was made based on clinical and radiological findings. The follow-up period was 12 months. Ethical approval was obtained from the ethics and research committee of ESUTH and informed consent was obtained from the patients’ caregivers.Statistical Package for Social Science (SPSS) version 21 (manufactured by IBM Corporation Chicago Illinois) was used for data entry and analysis. Data were expressed as percentages, median, mean, and range.

 **3. Results**

**3.1. Patients’ demographics**

Sixty two laparotomies were performed for peritonitis during the study period but only 52 cases had complete case records and formed the basis of this report. There were 40 males (76.9%) and 12 females (23.1%), which corresponds to a male to female ratio of 3.3:1. Details are depicted in Table 1.

Table 1: Demographic characteristics of the patients (n=52)

|  |
| --- |
|  Gender Male 40 (76.9%)  Female 12 (23.1%) |
|  Median age of the patients 9 years (2 weeks - 14 years)  |
| Median duration of symptoms prior to presentation 4 days (2–6). 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 - 3) 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 12 days (7-21) |

**3.2. Clinical features**

3.2.1. Presenting symptoms are shown in Table 2.

Table 2: Presenting symptoms of the patients

|  |
| --- |
|  Presenting Symptom Number Percentage |
|  Abdominal pain 28 53.8 Fever 10 19.2 Abdominal distension 6 11.6 Vomiting 5 9.6 Constipation 3 5.8  |

3.2.2. Clinical signs

Fifty two patients (96.2%) had generalized abdominal tenderness, 48 patients (92.3%) had abdominal rigidity with guarding. On digital rectal examination, 26 patients (50%) had collections in the rectovesical pouch.

**3.3. Radiological findings**

All the patients had plain abdominal radiograph; the radiographs were diagnostic in 5 patients (9.6%). Forty seven patients (90.4%) had abdominal ultrasound, out of which 26 patients (55.3%) showed echo rich peritoneal fluid. Computed tomography scan was not done due to non-availability of the facility.

 **3.4. Etiology of peritonitis**

Based on the intra-operative findings, the most common etiology causing peritonitis was typhoid intestinal perforation. Others are shown in Table 3.

Table 3: Etiology of peritonitis

|  |
| --- |
|  Intra-operative finding Number Percentage |
| Typhoid intestinal perforation 25 48.0Ruptured vermiform appendix 9 17.3 Perforated intussusception 8 15.4Perforated external hernia 3 5.8Perforated bowel due to AIOa 3 5.8Perforated NECb 3 5.8Bowel perforation due to abdominal trauma 1 1.9 |

bNEC= Necrotizing enterocolitis, aAIO=Adhesive intestinal obstruction

**3.5. Definitive operation performed**

The definitive surgeries are shown in Table 4.

Table 4: Definitive operation

|  |
| --- |
| Definitive Procedure performed Number Percentage |
| Closure of bowel perforation 26 50.0Appendectomy plus abscess drainage 9 17.3Right hemicolectomy with ITAc  8 15.4Segmental bowel resection 6 11.5Peritoneal drain insertion 3 5.8 |

cITA=Ileotransverse anastomosis

**3.6. Post-operative Complications**

Twenty-eight patients (53.8%) did not develop any complications. Surgical site infection occurred in 12 patients (23.1%) and this was the most common complication recorded in our patients. Other complications included enterocutanous fistula 5 (9.6%), intra-abdominal abscess 4 (7.7%) and wound dehiscence 3 (5.8%).

**3.7. Outcome**

Forty-two patients (80.8%) did well and were discharged home. Two patients (3.8%) signed out against medical advice. Mortality was recorded in 7 patients (13.5%). Most mortality was among the neonates.

**4. Discussion**

Secondary peritonitis is a common emergency surgical condition managed by surgeons all over the world and it represents a major cause of morbidity and mortality [6]. Secondary peritonitis results from loss of integrity of the gastrointestinal tract which results in contamination of the peritoneal cavity by endogenous microflora [6]. Despite antimicrobial therapy, surgical intervention is the cornerstone of the treatment of secondary peritonitis [7].

In the present study, the male dominance recorded is consistent with the report of other series on secondary peritonitis [5, 8, 9, 10]. However, Fowler reported female dominance with regards to primary peritonitis [11]. The median age of our patients of 9 years is similar to the reports of other studies [12, 13]. The published median ages of the patients who have peritonitis varies from 5 years to 11.8 years [10, 14, 15]. The median age of the patients who have peritonitis may be dependent on the predominant pathology in a particular setting. The late presentation of our patients is manifested in the 4-day median period before presentation to the hospital. This finding is consistently observed in the report of other studies [16, 17, 18]. This late presentation could be due to poverty and ignorance that is prevalent in developing countries. Delays in investigating the patients and paucity of funds may have accounted for the 48 hours lag period before surgery. In the current study, the length of hospital stay of our patients is similar to the reports of Osifo et al. [10]. However, Obinwa reported a median period of hospitalization of 6 days [12]. The length of hospital stay may be determined by the etiology of the peritonitis and age of the patients. Neonates who have peritonitis have longer hospital stay than older children [10].

Abdominal pain which was the predominant symptom in the present study was also the most common symptom in other studies [9, 17, 18]. The symptoms of abdominal pain, fever, abdominal distension, vomiting and constipation seen in our patients are similar to the report of Nuhu et al [17]. Typhoid intestinal perforation is the most common cause of peritonitis especially in developing countries [17]. This finding is in agreement with the finding of the present study. However, this is not supported by the reports of previous workers that reported ruptured appendix as the most common cause of secondary peritonitis in children [10, 12]. Typhoid intestinal perforation is a one of the most dreaded and common complication of typhoid fever [19]. Typhoid intestinal perforation is observed in 0.8% to 39% of typhoid fever [20].

The definitive procedure performed on our patients was dependent on the etiology of the peritonitis. Excision of the edge of the intestinal perforation and simple transverse closure in 2 layers was the most common performed procedure in our patients. A study done in Tanzania also adopts this method of treatment of typhoid intestinal perforation [21]. However, a study done in Zaria Nigeria advocated segmental ileal resection with primary end to end anastomosis for typhoid intestinal perforation [22, 23]

Laparotomy following peritonitis is froth with lots of post-operative complications. Surgical site infection which we recorded as the most common complication is also consistently observed by other researchers [5, 9, 17]. Enterocutanous fistula is a potentially catastrophic post-operative complication and was recorded in about one tenth of our patients. This is similar to the report of Nuhu et al [17]. However, a study done in Benin, Nigeria reported no incidence enterocutanous fistula following surgery for peritonitis [10]. Development of enterocutanous fistula after laparotomy may depend on the primary pathology or modality of treatment.

The mortality rate of 13.5% recorded in the present study is comparable to the reports of other authors [5, 9, 18,]. However, published mortality rates of secondary peritonitis ranges from 8.8% to 26.1% [5]. In the present study, the most common cause of mortality was overwhelming sepsis due to late presentation and complications arising from the surgery. Age of the patient, degree of peritoneal contamination and duration of surgery are some of the factors that may affect mortality in children who have peritonitis [5].

Strength of the study

Peritonitis from a wide range of causes in children was discussed. Data on pediatric peritonitis, unlike adult peritonitis, is not readily available especially in developing countries.

Weakness/ limitations of the study

This was a retrospective study; a prospective would have provided more information for analysis.

This study was limited by the small number of cases.

This was a single institution experience which may not be generalizable to other institutions.

**5. Conclusion**

In the present study, typhoid intestinal perforation and closure of bowel perforation were the most common etiology of peritonitis and most common performed surgical procedure respectively. The current state of things should be improved upon.

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

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**Ethical approval:** Ethical approval was obtained from the hospital ethics committee.

**Consent for publication**: Not applicable

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