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Research Article

Negative Appendectomy in Children in a Tertiary Hospital in Enugu, Nigeria

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Abstract

Background: Appendectomy is one of the most performed general surgical emergency operations and negative appendectomy rate is a quality metric in the management of appendicitis. The aim of this study was to evaluate our experience in the management of children with suspected appendicitis who had negative appendectomy.

Materials and Methods: This was a retrospective study of children aged 15 years and younger who were managed for acute appendicitis between January 2010 and December 2019 at the pediatric surgery unit of Enugu State University Teaching Hospital (ESUTH) Enugu, Nigeria. The specimens (removed appendix) were assessed histologically for the presence or absence of any pathology. Positive and negative appendectomies are defined by the presence or absence of pathology/inflammatory cells on histopathological examination of the removed vermiform appendix respectively.

Results: There were 582 appendectomies performed for acute appendicitis during the study period; out of this number, 58 (10.1%) cases were negative appendectomies with a female predominance. Majority of the patients presented after 48 hours of onset of their symptoms. Abdominal pain and abdominal ultrasound were the most common presenting symptom and imaging investigation respectively. All the patients had appendectomy and surgical site infection was the most common post-operative complication. Two (3.4%) patients expired from overwhelming sepsis.

Conclusion: Negative appendectomy may be associated with some morbidity and mortality. One in 10 children who had appendectomy for suspected acute appendicitis does not require the procedure.

Keywords: *Appendectomy; Children; Negative; Tertiary Hospital*

Introduction

Acute appendicitis is a common abdominal emergency condition worldwide. Diagnosis of acute appendicitis is based on clinical assessment, laboratory and radiological investigations and appendectomy is the definitive treatment [1,2]. Appendectomy is one of the most performed general surgical emergency operations and negative appendectomy rate is a quality metric in the management of appendicitis [3]. In the literature, different criteria have been used to define negative appendectomy. Some authors have defined negative appendectomy as the absence of inflammation or other pathology in the appendix [4]. Histologically, appendicitis is the presence of inflammatory cells (polymorphonuclear leucocytes, lymphocytes or plasma cells) in the appendix [3]. Corollary, the absence of inflammatory cells in the appendix is considered negative appendectomy. Surgical excision of a normal appendix exposes the patients to unnecessary anesthesia

and surgical complications [5]. Negative appendectomy may result from inadequate clinical assessment or unavailability of diagnostic modalities [5]. A number of pathological conditions present like acute appendicitis. In evaluating a child with suspected acute appendicitis, the clinician wants to avoid the danger of a possible perforation as well as the event of negative appendectomy [6]. Its been reported that 15 - 25% of the appendix removed for the presumed diagnosis of acute appendicitis are normal [6]. The traditional teaching concerning acute appendicitis used to be "when in doubt, take it out". There are reasons to question this assertion as the complication rate of negative appendectomy is similar to that of operation for simple appendicitis [7]. There is pain, emotional upset, financial cost and social disruption associated with negative appendectomy: negative appendectomy should therefore be avoided. There is paucity of data on negative appendectomy in children in Enugu, South East Nigeria.

Aim of the Study

The aim of this study was to evaluate our experience in the management of children with suspected appendicitis who had negative appendectomy.

Materials and Methods

This was a retrospective study of children aged 15 years and younger who were managed for acute appendicitis between January 2010 and December 2019 at the pediatric surgery unit of Enugu State University Teaching Hospital (ESUTH) Enugu, Nigeria. Patients who have had laparotomy were excluded from this study. Patients who had incidental, prophylactic and interval appendectomy 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/km^2. The hospital also receives referrals from its neighboring states. Information was extracted from the case notes, operation notes, operation register, histopathological results and admission-discharge records. The information extracted included the age, gender, presenting symptoms, duration of symptoms before presentation, time interval between presentation and intervention, investigation performed, intra-operative finding, operative procedure performed, complications of treatment, duration of hospital stay and outcome of treatment. Diagnosis of acute appendicitis was made based on clinical and radiological findings. For the purposes of this study, positive and negative appendectomies are defined by the presence or absence of inflammatory cells on histopathological examination of the vermiform appendix. 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.

Result

Patients' demographics

There were 582 appendectomies performed for acute appendicitis during the study period but only 572 cases had complete case records. There were 190 males (33.2%) and 382 females (66.8%), which corresponds to a male to female ratio of 1:2. Positive appendectomy was confirmed in 514 (89.9%) patients while 58 (10.1%) patients had negative appendectomy and forms the basis of this report. Details are depicted in table 1.

Gender	
Male	19 (32.8%)
Female	39 (67.2%)
Median age of the patients	8 years (4 years - 14 years)
Median duration of symptoms prior to presentation	3 days (1-7)
Presented within 24 hours	8 (13.8%)
Presented between 24 and 48 hours	12 (20.7%)
Presented after 48 hours	38 (65.5%)
Median duration from presentation to surgery	2 days (1 - 4)
Within 24 hours	7 (12%)
Between 24 and 48 hours	32 (55.2%)
After 48 hours	19 (32.8%)
The mean duration of hospital stay	8 days (5 - 18)

Table 1: *Demographic characteristics of the patients (n = 58).*

Clinical features

Presenting clinical features are shown in table 2.

Clinical features	Number of patients (%)
Abdominal pain	54 (93.1)
Vomiting	35 (60.3)
Nausea	25 (43.1)
Fever	30 (51.7)
Anorexia	18 (31)
Urinary symptoms	6 (10.3)
Non-specific symptoms	14 (24.1)
Right iliac fossa tenderness	49 (84.4)
Rebound tenderness	36 (62)

Table 2

Investigations performed

All the patients had abdominal ultrasound. However, only 5 (8.6%) patients had a negative report of acute appendicitis from the ultrasound scan: These patients were operated on based on convincing clinical findings. Nineteen (32.8%) patients had a plain abdominal x ray. None of the x rays was supportive of acute appendicitis. Barium meal and follow through were performed in 4 (6.9%) patients. Acute appendicitis could not be confirmed on barium meal. A clinical differential of intestinal malrotation necessitated the barium meal and follow through. Computed tomography (CT) scan was performed in 8 (13.8%) patients. All the CT scans were conclusive of acute appendicitis. Atypical presentation of the patients was the indication for the CT scan. Magnetic resonance imaging (MRI) was not performed in any of the patients due to its non-availability.

Intra-operative finding

All the 58 patients, whose vermiform appendices were negative histologically, looked non-inflamed at surgery. However, there were 31 other vermiform appendices that looked normal at surgery but the histology confirmed the presence of inflammatory cells. The surgeon's perception may be unreliable.

Operative procedure performed

Appendectomy was the operative procedure performed in all the patients.

Complications of treatment

Eleven (19%) patients had surgical site infection, intra-abdominal abscess was recorded in 6 (10.3%) patients and 2 (3.4%) patients had enterocutaneous fistula. Post-op bands occurred in 1 (1.7%) patient.

Treatment outcome

Fifty-six (96.6%) patients achieved full recovery and were discharged home. Two (3.4%) patients expired from overwhelming sepsis.

Comorbidities in the negative appendectomy patients

Two (3.4%) patients had hemoglobinopathies (sickle cell anemia) and 1 (1.7%) patient each had lymphoproliferative disorder, renal impairment and juvenile diabetes mellitus. No case of inflammatory bowel disease was seen in any of the patients that had negative appendectomy.

Discussion

The lifetime risk of acute appendicitis ranges from 6.7% to 8.6% and the corresponding lifetime risk of emergency appendectomy is 12 to 23.1% [8]. Perforation of the appendix may result from delays in diagnosis whereas wrong diagnosis of acute appendicitis results in unnecessary (negative) appendectomy [9]. Historically, performing a negative appendectomy was justified to reduce the incidence of perforation. In addition, it was believed that negative appendectomy was associated with minimal morbidity and cost [10].

In the present study, there is female predominance. This is consistent with the reports of some authors but inconsistent with the report of others [3,5,11,12]. The reason for the female predominance may be due to gynecological problems of the female that may masquerade as acute appendicitis. Alhamdani., *et al*. reported that 22% of negative appendectomy in females is due gynecological conditions [5]. Klein., *et al.* reported that the diagnosis of acute appendicitis is more difficult in young children and adolescent girls; the rate of negative appendectomy is therefore higher in these categories [13]. The age range of our patient, who had negative appendectomy, was 4 to 14 years. This is at variance with the report of Aworanti., *et al* [14]. The age difference may be explained by the cohort of patients recruited by the different studies. Majority our patients presented after 48 hours of onset of their symptoms. The low level of enlightenment, poverty and ignorance prevalent in low income countries may explain this delayed presentation. The average interval of 48 hours before treatment was the period required for proper investigation and evaluation before surgery. Following appendectomy, the period of hospitalization of the patients is not in agreement with the report of Chen., *et al* [15]. The predominant modality of treatment may determine the duration of hospitalization of the patients [15].

In the current study, abdominal pain was the most common and consistent symptom the patients presented with. This is in line with the report of Alhamdani., *et al* [5]. However, some patients may present atypically which may cause delays in making diagnosis. Some of the atypical symptoms include left iliac fossa pain, urinary symptoms and tenesmus [16]. These atypical presentations are due to variations in length and location of the appendix [16].

All the patients in the index study had an abdominal ultrasound scan. Ultrasound is the first imaging modality of choice for diagnosing acute appendicitis [17]. Although ultrasound may be less sensitive than CT scan and MRI, its availability, low cost and low radiation make ultrasound the initial imaging investigation [17]. However, in cases of equivocal ultrasound findings, further imaging (CT/MRI) is recommended [18]. However, the non-affordability, non-accessibility and non-availability of these imaging modalities (CT/MRI) limit their use in developing countries.

Confirmation of negative or positive appendectomy was done at histology despite the macroscopic appearance of the appendix at surgery. Gross appearance of the appendix is unreliable for the diagnosis of an inflamed appendix [19]. Roberts., *et al.* reported that about one-third of appendices perceived as normal at appendectomy demonstrated histological signs of inflammation [19].

Surgical site infection was the most common post-operative complication recorded in the present study. Other studies also reported wound infection as one of the most common complications following appendectomy [20,21]. Following appendectomy in immunocompromised patients (such as HIV infection) surgical site infection is 20 times more common [22]. Intra-abdominal abscess is a serious complication of appendectomy and surgical drainage is usually required [23]. Al-Salem., *et al*. reported that appendectomy is the commonest

operation leading to adhesive intestinal obstruction [24]. Adhesive bowel obstruction has been reported in about 5% of the patients after negative appendectomy [6].

The 2 patients who expired in the current study were as a result of overwhelming sepsis. The mortality rate recorded in the present study is at variance to the report of Paya., *et al* [25]. Differences in mortality may be due to nature of the inflamed appendix, complications arising from the inflamed appendix and the complications of the surgery.

Comorbidities may be seen in children who had negative appendectomy. Andersson and Andersson also reported the association between comorbidities such as renal insufficiency, diabetes mellitus, cardiovascular diseases and mortality following negative appendectomy [26]. None of our patients had inflammatory bowel disease. However, one study from Portugal reported that appendectomy is associated with inflammatory bowel disease [26]. This is due to the importance of the vermiform appendix in intestinal homeostasis and in the prevention of certain pathologies [27].

Limitations of the Study

1. Retrospective nature of the study: A prospective analysis would have provided more information such as Avarado score.

2. This study has a small sample size. A larger number of patients would have provided better analysis.

Conclusion

Negative appendectomy may be associated with some morbidity and mortality. One in 10 children who had appendectomy for suspected acute appendicitis does not require the procedure. It is recommended that Avarado score should be used in the assessment of children with suspected clinical features of intussusception. Every effort should be geared towards decreasing negative appendectomy and its possible complications and cost to the patients and hospital.

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