Brief Communication

ACUTE APPENDICITIS IN CHILDREN ADMITTED TO ZEWDITU MEMORIAL HOSPITAL

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ABSTRACT

***Background**: Acute appendicitis is the most common cause of acute abdomen in children. The rate of appendicular perforation may be related to duration from the onset of symptom presentation to treatment.*
***Objective**: To describe the clinical characteristics and assess symptom duration as a risk factor for perforation in children with acute appendicitis.*
***Patents and methods**: A retrospective analysis of medical records of 322 children under 15 years of ages with intraoperative diagnosis of acute appendicitis between the periods of September 2006 and August 2010.*
***Results**: Acute appendicitis accounted for 87.5% of all cases of acute abdomen during the study period. Two hundred patients were boys and 122 patients were girls giving male to female ratio of 1.6:1. The mean and median ages were 10.4 and 11 years respectively. The youngest patient was 3 years old. The peak age range was 10-14 years. The most common presenting symptoms were abdominal pain (100%), anorexia (85.1%), vomiting (83.9%), and fever (82.3%). Right lower quadrant tenderness was the leading physical finding observed in 83.9% of patients. The mean duration of symptoms in children with non-perforated appendicitis was 2.5 days whereas the mean duration of symptoms in children with perforated appendicitis was 5.2 days. The mean length of hospital stay in children with non-perforated appendicitis was 3.6 days whereas the mean length of hospital stay in children with perforated appendicitis was 8.4 days. Leucocytosis was observed in 74.5% of children and the mean leucocyte count was 13150/mm³. The incidences of perforation if symptoms were present for less than 24 hours,24-48 hours and more than 48 hours were 4.1%, 10.2%, and 45.3%, respectively. Postoperative wound infection was observed in 1.9% and 31% of children with non-perforated and perforated appendicitis, respectively. Two children died in the hospital.*
***Conclusion**: Acute appendicitis was the commonest cause of acute abdomen in children. It was more prevalent in children aged 10-14 years. The commonest presenting symptoms and signs were abdominal pain, anorexia, vomiting, and fever and right lower quadrant tenderness. The risk of perforation is directly proportional to the duration of illness at presentation. Perforated appendicitis was associated with increased morbidity, mortality and prolonged hospital stay.*
***Keyword**: appendicitis, clinical characteristics, symptom duration, appendicular perforation*

INTRODUCTION

Acute appendicitis refers to acute transmural inflammation of the vermiform appendix. It is the most common acute surgical condition in children (1-3). In the USA, the incidence of acute appendicitis increases from an annual rate of 1-2 per 10000 children between birth and 4 years of age to 19-28 per 10000 children younger than 14 years (4, 5). Acute appendicitis was very rare in African populations but it is now thought to have increased in incidence. This is believed to be due to the adoption of more western patterns of life(6). In some parts of the African continent, it has become one of the commonest surgical emergencies(7,8). Appendicitis could occur in all age groups but its incidence peaks in the second decade of life and rarely occurs in infants. It affects males more often than females (1,4,9,10).

Appendicitis in children has broad spectrum of clinical presentation depending on the timing of presentation, the patient's age, the position of the appendix, and individual variability in the evolution of the disease process. Because of the multitude spectra of

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clinical presentation , it may be difficult to distinguish appendicitis from other causes of abdominal pain. Whereas the classic presentation of acute appendicitis is well described, this represents less than half the cases(1,9,10). A child with acute appendicitis may present with abdominal pain, vomiting and diarrhea, whereas the clinician, due to the commonness of the disease, may entertain acute gastroenteritis as the first impression which would lead to misdiagnosis, inappropriate treatment and complications. A primary focus in the management of acute appendicitis is avoidance of sepsis and the infectious complications seen in association with perforation. Appendicular perforation is a major problem in children. Various factors have been mentioned to be associated with appendicular perforation and complication. Delay in diagnosis was reported as a risk factor for perforation in studies by Michael B., et al(11) and Abantanga FA(12). Parental delay was observed as a major risk factor in a study by Eldar et al (13).The objectives of this study, therefore, were to describe the clinical characteristics and assess the relationship between duration of symptoms with appendicular perforation at Zewditu hospital, and to compare results with other studies.

PATIENTS AND METHODS

This is a retrospective analysis of children under 15 years of ages who were operated up on for acute appendicitis at Zewditu Memorial Hospital (ZMH) in Addis Ababa, Ethiopia. The hospital is a referral hospital that delivers surgical services to elective and emergency patients coming from the city and neighbouring villages. It is also a teaching hospital that provides surgical education to medical students and surgical residents.

All medical records of children under 15 years of age who were operated for acute appendicitis at ZMH between September 2006 and August 2010 were reviewed. Children with intraoperative diagnosis of acute appendicitis were considered eligible for the study. Variables were extracted on a prepared format and data were descriptively analysed using EPI-INFO version 6.04 statistical software with Chi-square test. A P-value <0.05 was taken as a level of significance and results were presented in percentage and tables.

RESULTS

A total of 416 children were operated up on for acute abdomen during the study period. Out of these ,375 children were operated up on for a clinical diagnosis of acute appendicitis. Out of the 375 children, 11 (6boys and 5 girls) had negative appendectomy for grossly normal looking appendices whereas acute appendicitis was entertained in the remaining 364 children. Out of the 364 children with intraoperative diagnosis of acute appendicitis, medical records of 322 children were possible to retrieve for inclusion in this study.

Out of the 322 patients,200 were boys and 122 were girls giving male to female ratio of 1.6:1. Two hundred ninety three children (91%) were from Addis Ababa and 29(9%) were from outside Addis Ababa. The mean age was 10.4±2.1 years and 11 years was the median age. The youngest child was 3 years old. The peak age range was 10-14 years. The age and sex distribution of patients is shown on Table 1.

Table 1: Demographic characteristics in 322 children operated for acute appendicitis, ZMH, September 2006-August 2010

Characteristics		Frequency	Percentage
Age	0-4	2	0.6
	5-9	111	34.5
	10-14	209	64.9
	Mean age	10.4± 2.1	
	Median	11	
	Range	3-14	
Sex	M	194	60.2
	F	128	39.8
Resident	Addis Ababa	293	91.1
	Outside Addis Ababa	29	9.0

Symptoms and signs of presentation to the hospital are shown on Table2. All patients had abdominal pain and migration of pain to the right lower quadrant was observed in 64.9% of children. Anorexia and vomiting were the next common presenting symptoms. Right lower quadrant (RLQ) tenderness was the leading physical finding observed in 83.9% of patients. The duration of symptoms before presentation ranges from 12 hours to 5 days with the average duration being 2.5±1.3 days with a median duration of 3 days in children with simple appendicitis; whereas the duration of illness at presentation in children with perforated appendicitis ranges from 24 hours to 15 days with the average duration being 5.2±1.7 days with a median duration of 5.5 days ($p<0.03$).The average length of hospital stay in children with simple appendicitis was 3.6±1.4 days, median 4 days with a range of 2-6 days whereas the average length of hospital stay in children with perforated appendicitis was 8.4±2.3 days, median 8.5 days with a range of 6-25 days($p<0.01$).

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Table 2: Clinical presentation in 322 children operated for acute appendicitis, ZMH, September 2006-August 2010

Clinical presentation*	No of Patients (%)
Symptoms	
Abdominal pain	322(100)
Anorexia	274(85.1)
Vomiting	270(83.9)
Fever	265(82.3)
Pain shift to the RLQ	209(64.9)
Constipation	59(18.3)
Diarrhoea	49(15.2)
Signs	
RLQ direct tenderness	270(83.9)
Rebound tenderness	189(58.7)
Generalised tenderness	52(16.1)
RLQ mass	11(3.4)

*N.B. multiple symptoms and signs are possible

Duration of illness at presentation in children with

- Non perforated appendicitis: Mean 2.5±1.3 days (Range 12 hours -5 days)
- Perforated appendicitis: Mean 5.2±1.7 days (Range 24 hours-15 days)

Hospital stay in children with

- Non perforated appendicitis: Mean 3.6±1.4 days (Range 2-6 days)
- Perforated appendicitis: Mean 8.4±2.3 days (Range 6-25 days)

Table 3 shows the leucocyte count of the patients. Leucocytosis (WBC count >10000/mm³) was found in 74.5% of the patients and neutrophila (neutrophil count percentage >75) was observed in 71.1% of children. The mean leucocyte count was 13150/mm³ with a range 2890-44420/mm³.

The intraoperative gross pathologic findings were shown on Table 4. Simple appendicitis was found in 32.3% of patients and appendicular perforation was observed in 59.6% of children. The incidences of perforation if symptoms were present for less than 24 hours, 24-48 hours and more than 48 hours were 4.1%, 10.2% and 45.3 %($p<0.001$), respectively.

Table 3: White blood cell (WBC) count in 322 children operated for acute Appendicitis ,ZMH, September 2006-August 2010.

WBC count(/mm³)	No of patients (%)
2890-10000	82(25.5)
10001-20000	209(64.9)
20001-30000	20(6.2)
>30000	11(3.4)
Neutrophils (%)	
>75	229(71.1)
≤75	93(28.9)

Table 4: Intraoperative gross pathologic findings in 322 children operated for acute appendicitis, ZMH, September 2006-August 2010

Gross pathology	No of patients (%)
Simple appendicitis	104(32.3)
Gangrenous appendicitis	6(1.9)
Perforated appendicitis	192(59.6)
Appendiceal abscess	20(6.2)
Total	322(100)

Postoperative wound infection was observed in 1.9% and 31% of children with non-perforated and perforated appendicitis, respectively ($p<0.001$). Two children (0.62%) died postoperatively. Both were eight years old female children who came after a week from the onset of their illness and had perforated appendicitis with generalised peritonitis.

DISCUSSION

Acute appendicitis is the most common acute surgical condition in children and a major cause of childhood morbidity (1-3). In our study acute appendicitis accounted for 87.5% of acute abdominal emergencies in children .Acute appendicitis accounted for 62.3% of all abdominal emergencies in children in a study conducted in Bangui, Central African Republic (14).The negative appendectomy rate in this study was 2.9%. Negative appendectomy rate of 5% was observed in a study by Kosloske AM, et al(15). Negative appendectomy rates of 14%(16) , 15%(17) and 17%(18) were reported in other studies. The low rate of negative appendectomy that was observed in this study may be because the diagnosis of appendicitis in our set up was based on a subjective perception of macroscopically abnormal appendix rather than more objective microscopic findings. Even if no apparent explanation could be given ,the male to female ratio was 1.6:1 in this study and higher incidences of acute appendicitis were also observed in males in other studies with a male to female ratio of 1.3:1(19), 1.4:1(4,20), 1.5:1(21), 1.7:1(22), and 2.2:1 (12). We observed that the mean age of children with acute appendicitis was 10.4±2.1 years. A mean age of 10.1±2.8 years(12), 9.6 years(15), 10 years(19), 12 years(20), and 9.3 years(22) were reported in other studies. The median age in our study was 11 years and this was shown to be 8 years in Abebe's et al study (22). The highest incidence of acute appendicitis was observed in age group between 10-14 years in this study and this was shown to be between 10-12 years in the study by Orvar J et a l(21). Abebe B., et al , however, showed 5-10 years of age to be the peak incidence of acute appendicitis (22). The youngest child in this series was 3 years old and the same was observed in a Nigerian study (23).The youngest age in Kosloske's, et al (15) and Abebe's , et al (22) reports was 1 year. Four years of age was the youngest child in Willmore's, et al report (16).Six months of age, however, was the youngest age in the study by Pearl RH et al (20).

Absence of cases of acute appendicitis in children under 3 years of age in our series may be due to misdiagnosis. The commonest presenting symptoms and signs in this study were abdominal pain, anorexia, vomiting, fever and RLQ tenderness which were observed in 100%,85.1%,83.9%,82.3% and 83.9% of the patients, respectively. Abdominal pain (98%), fever (86%),vomiting (82%),and RLQ tenderness (90%) were the commonest symptoms and signs observed in Orvar J, et al study (21). The commonest presenting symptoms and signs observed by Abebe B., et al were abdominal pain (99.3%), fever(91.2%), vomiting(90.5%) and direct abdominal tenderness(98%). Anorexia was observed in only 10.2% of the cases which is far lower than from our finding(22).Diarrhea was observed in 15.2%of children in this series and 11.6% was the observation made by Abebe et al (22).

Diarrhea was found in 7.6% of adult patients in a study by Abraham D., et al(24). This shows that diarrhea as symptom of acute appendicitis may be seen more in children than in adults. The study showed that the mean durations of symptoms before presentation in children with non-perforated and perforated appendicitis were 2.5±1.3 and 5.2±1.7 days respectively and this shows that delayed presentation was significantly associated with appendicular perforation which is in agreement with other

studies (12,13,22,25). In this study the median length of hospital stay in children with non-perforated appendicitis was 3.5 days whereas the median length of hospital stay in children with perforated appendicitis was 8.5 days indicating a significant association between appendicular perforation and prolonged hospital stay which is in agreement with observations by Abebe B., et al (22), Narsule CK, et al(25),Nance ML,et al(26)) and Esposito C, et al (27). The prolonged hospital stay observed may be due to the associated morbidities following appendicular perforation.

Leucocytosis with neutrophil predominance was observed in the majority of our patients and this was in line with other studies (21,22,26,28,29) but Adekunle O.O., et al from Nigeria observed leucocytosis in only 48% of their patients which is far lower than our finding (23).Appendicular perforation was found in 59.6% of patients in this study and comparable perforation rates were reported in other studies (21,22,30,31).When compared to this study, apparently lower rates of perforations were reported in studies by Michael B., et al(37%)(11), Eldar S., et al, (32%)(13), Willmore W.S., et al (22%)(16) and Birhanu K., et al (41%)(32). The higher rates of perforation that was observed in this series was the result of delayed presentation.

The wound infection rate in children with perforated appendicitis was 31% and this was shown to be 27.6% in a study by Orvar J et al (21). When compared to the wound infection rate in non perforatedappendicitis(1.9%), perforative complication is associated with higher rate of wound infection. A mortality rate of 0.62% was observed in this study. Mortality rates of 0 %(20, 33, 34),1.0%(12), 2.7% (21), 0.68%(22), and 0.4 % (35) were reported in other studies. The mortality rate observed in this study, even if comparable to or even better than from some other African studies, may be significant when compared to the 0% mortality from the developed world and this may be due to better awareness of the disease and better health care facilities in the Westerners.

In conclusion: Acute appendicitis was the commonest cause of acute abdominal emergency in children in ZMH. It was more prevalent in children aged 10-14 years .The commonest symptoms and signs of presentation were abdominal pain, anorexia, vomiting, fever and RLQ tenderness. The risk of perforation was directly proportional to the duration of illness at presentation. Perforated appendicitis was associated with increased morbidity, mortality and prolonged hospital stay. Lack of parental awareness about the disease and misdiagnosis at prehospital levels may be reasons for late presentation. Further prospective study is recommended .

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