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CLINICAL PROFILE AND RISK FACTORS FOR PERFORATION OF ACUTE APPENDICITIS IN CHILDREN

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CLINICAL PROFILE AND RISK FACTORS FOR PERFORATION OF ACUTE APPENDICITIS IN CHILDREN

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ABSTRACT

Objectives: To describe the clinical profile and determine the risk factors associated with perforation of appendix in children under 13 years of age.

Design: A retrospective review of charts of children admitted for appendicitis between the year 1999 to 2000.

Setting: Department of Paediatrics and Child Health, Tikur Anbessa Specialised Hospital, Addis Ababa University, Addis Ababa, Ethiopia.

Subjects: A total of 147 children under the age of 13 years admitted for acute appendicitis.

Results: A total of 147 cases were analysed. The mean age was 9.3 years and appendicitis occurred more commonly among males. Factors independently found to be predictors of perforation by univariate analysis were: age <10 years, duration of illness for over 24 hours, history of treatment elsewhere before arrival to TAH, generalised abdominal tenderness, rebound tenderness and/or rigidity, hypoactive and/or absent bowel sound, RLQ mass, leukocytosis with neutrophilia and presence of complications. However, none of these was retained as significant factors in the multiple logistic regression analysis.

Conclusion: There are many factors that are associated with perforation but there is no single factor that independently predicted perforation of appendicitis. Delay in intervention due to late presentation to hospital is an important preventable factor.

INTRODUCTION

The difficulty in distinguishing appendicitis from other common causes of abdominal pain and the increase in morbidity and mortality accompanying perforation make appendicitis an important concern for clinicians. Unrecognised appendicitis leading to life threatening complications is not uncommon in our region. Appendicitis occurs in all age groups but the incidence increases with age peaking in adolescence and rarely occurring in infants (1-3).

Perforation of the appendix remains a major problem in children with appendicitis. In many studies the incidence of gangrenous and/or perforated appendicitis is 27% to 62% (1-7). In Ethiopia the

perforation rate in children was 67% as shown in an earlier study (8). A Sudanese study showed a perforation rate of 13.2%, 3.9% appendiceal mass and 0.7% appendiceal abscess (9). A number of factors have been found associated with perforation (1-7). Duration of symptoms is one of the most significant predictors of perforation. In a USA study a delay by greater than 36 hours was associated with perforation rates of 65% in children. As opposed to previous studies both preadmission (parental) delay and post admission (professional) delay were associated with perforation but professional delay more strongly so. After adjustment for duration, age remained the significant factor associated with perforation with the highest perforation rate occurring between zero to four years

(80%). Incidence of perforation for the most part decreased with age (1). A study by Michael and David revealed a perforation rate of 37% delay in diagnosis being the single most important risk factor (4). In the series by Eldar *et al* (5) the rate of advanced disease (gangrenous and/or perforated) was 32% where parental delay adversely increased the risk for perforation.

Complications occurred in 25-30% of children with appendicitis primarily among those with perforation. These complications included wound infections, 0-2% for non-perforated and 10-15% for perforated. Intra abdominal abscess is rare in simple appendicitis but occurs in 4% to 6% of those with perforation. Others include intestinal obstruction, infertility, etc. The mortality rate of appendicitis is low, 0.5-1% in most series (1,7,10-13).

In order to prevent perforation and complications it is important to identify factors that could predict patients who are likely to develop perforations and/or complications due to appendicitis. Therefore, the objectives of this study was to describe the clinical profile and the risk factors for appendiceal perforation in children at the department of paediatrics and child health.

MATERIALS AND METHODS

The study was conducted at Tikur Anbessa Hospital, Department of Paediatrics and Child Health (DPCH), Addis Ababa University, which is a national referral centre for sick children. All patients who were treated as cases of appendicitis at the DPCH between January 1999 to January 2000 were included in the study.

In the department only children under thirteen years of age are admitted as paediatric patients.

Data from the records of patients were collected using a format specially prepared for this purpose. The collected data were entered into a computer and analysed using SPSS statistical package. Frequencies, rates and risk factors for perforation were computed against various variables. Multiple logistic regression was used to identify independent risk factors for appendiceal perforation.

In this study gangrenous appendicitis was included as perforated appendicitis because the clinical manifestations and the course of the illness are similar.

Formal consent to conduct the study was obtained from the DPCH of Tikur Anbessa Hospital.

RESULTS

There were a total of 147 cases of appendicitis admitted to the department of which 93 (63.26%) were males and 54 (36.73%) were females. The age range was one to twelve years with the mean and median ages being nine point three years and eight years respectively. Most of the cases were in the age group five to ten years (57.8%) followed by age group greater than ten years (36.1%). Children less than five years accounted for 6.1% of all cases.

The majority of the patients had at least one sibling (88%). Most of the parents were literate with 92.8% of fathers and 84.4% of mothers being able to read and write. Over 90% of the patients were fully vaccinated and family history of appendicitis was reported in only three patients (2.1%).

As shown in Figure 1 the commonest symptoms of appendicitis were abdominal pain (99.3%), fever (91.2%) and vomiting (90.5%) with additional other symptoms (33.3%). Above a quarter of all patients were found to be underweight and stunted; 98% had direct abdominal tenderness, 72.1% rebound tenderness and/or rigidity, with right lower quadrant (RLQ) mass found in 7.5% of patients. The site of abdominal pain at onset was periumbilical in 78.6% followed by RLQ in 13.1% of patients. Radiation of abdominal pain was reported in 76.9% of patients, the commonest site of radiation was to the RLQ of the abdomen. Bowel sound was normoactive in 40.8% and absent or hypoactive in 17.9%. At operation, perforated appendix was found in 54.4% and phlegmonous appendix in the rest (45.6%).

Over two-thirds of patients had WBC count of $>10,000/\text{mm}^3$ with predominant neutrophilia in 90.2%. Predominant neutrophilia was found more common among patients with perforated appendicitis ($P<0.01$). Urinalysis showed pyuria and microscopic haematuria in 25% of patients. The level of haematocrit and type of blood groups is not that different between the two groups of patients ($P>0.05$).

Complications included wound infection (8.16%), intra-abdominal abscess (9.52%), intestinal obstruction (2.72%) and entero-cutaneous fistula (1.36%). Out of 147 cases, 24 (16.33%) patients had complications and 21 of them were in the group with perforation suggesting that the occurrence of complication is highly predictive of a perforated appendix ($P<0.05$). There was one death (0.68%).

Figure 1

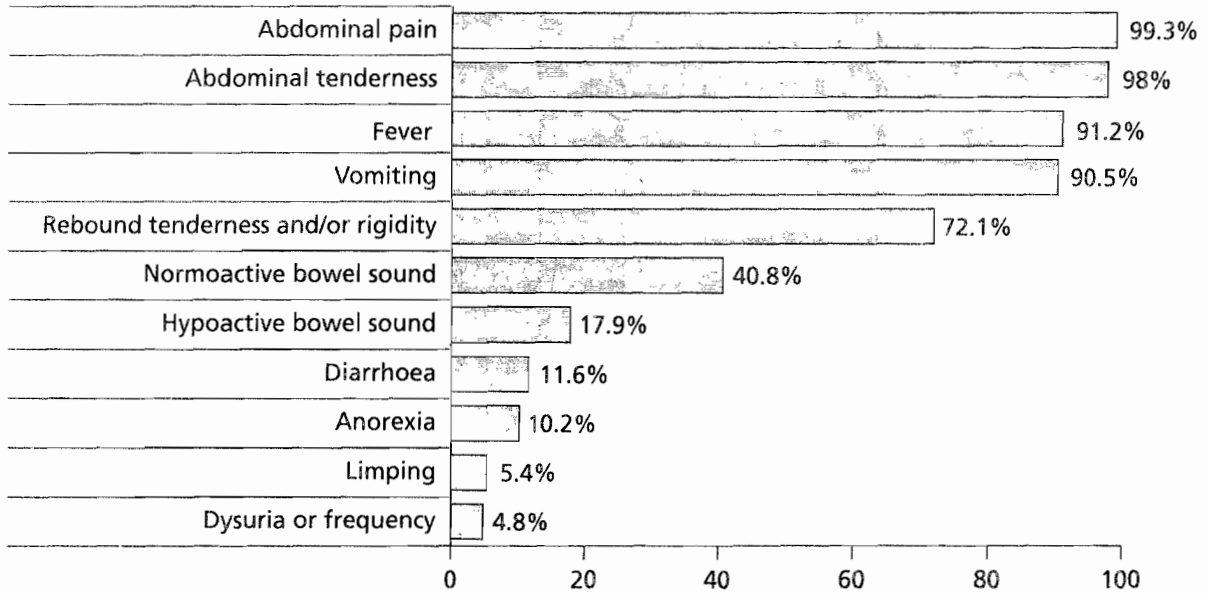
Distribution of symptoms and signs of acute appendicitis

Table 1

Frequency and type of complications observed in 147 patients

Complication	Frequency	(%)
Wound infections	12	8.16
Intra-abdominal abscess	14	9.52
Intestinal obstruction	4	2.72
Entero-cutaneous fistula	2	1.36
Other	1	0.68

Table 2

Risk factors for perforation of appendicitis

Variable		Not perforated	Perforated	OR	95% CI	
Age	≤10 years	37	57	1.00		
	> 10 years	30	23	*0.498	(0.251,0.985)	
Sex	Male	44	49	1.00		
	Female	23	31	1.21	(0.421,2.436)	
Education status	Father	Illiterate	1	6	1.00	
		Literate	66	74	0.187	(0.022,1.593)
	Mother	Illiterate	5	10	1.00	
		Literate	62	70	0.565	(0.183,1.742)
Monthly income (Birr)	≤500 /	42	55	1.00		
	>500 /	25	25	0.764	(0.385,1.574)	
Family history of appendicitis	Yes	2	1	1.00		
	No	63	78	2.476	(0.219,27.939)	

Table 2 (continued)

Variable		Not perforated	Perforated	OR	95% CI
Duration of illness	≤ 24 hours	31	11	1.00	
	>24 hours	36	69	*5.042	(2.434,11.988)
Prior treatment	Yes	7	27	1.00	
	No	59	50	*0.220	(0.088,0.547)
Abdominal pain	Yes	67	79	1.00	
	No	0	1	0.541	(0.466,0.628)
Fever	Yes	58	76	1.00	
	No	9	4	0.339	(0.100,1.156)
Vomiting	Yes	58	75	1.00	
	No	9	5	0.430	(0.137,1.351)
Radiation of pain	Yes	48	62	1.00	
	No	18	15	0.645	(0.285,1.410)
Nutritional Status	Normal	11	23	1.00	
	Abnormal	46	50	0.520	(0.228,1.183)
Site of abdominal tenderness	RLQ only	55	46	1.00	
	Generalised	8	31	*4.633	(1.940,11.062)
Rebound tenderness	Yes	39	67	1.00	
	No	26	12	*0.269	(0.122, 0.592)
Site of rebound tenderness	RLQ only	33	44	1.00	
	Generalised	4	23	*4.313	(1.360,13.671)
RLQ abdominal mass	Yes	0	10	1.00	
	No	67	69	*0.152	(0.013,0.839)
Bowel Sound	Absent/ Hypoactive	5	21	1.00	
	Normal/Hyperactive	32	28	*0.208	(0.069,0.625)
WBC-count	≤13,500	37	33	1.00	
	>13,500	18	39	*2.429	(1.171,5.038)
Neutrophils	≤ 62%	6	1	1.00	
	>62%	17	28	*2.647	(1.819,3.851)
Haematocrit	≤35%	6	8	1.00	
	>35%	59	70	0.880	(0.292,1.1849)

OR = Odds ratio CI = Confidence interval * Statistically significant

Prior to arrival to Tikur Anbessa Hospital 23.8% were seen at other health institutions and were treated for another diagnosis such as urinary tract infection and intestinal parasitosis.

The rate of perforation is more common in those patients below ten years of age; 97 out of 147 patients were below ten years of age had perforated appendicitis as compared to those above ten years which is 53 only ($P<0.05$).

Sex, vaccination and nutritional status of patients, family income, educational status of parents and the number of siblings showed no significant difference in the rate of perforation ($P>0.05$). None of the reported subjective complaints by the patients like fever, abdominal pain, vomiting, anorexia etc are singly or in combination found to have significance in predicting perforation ($P>0.05$).

Presence of generalised abdominal tenderness and rebound tenderness and/or rigidity, absent or hypoactive bowel sound were highly suggestive of perforation ($P<0.01$).

The length of hospital stay was longer for those with perforation accounting for 66% of those who had stayed longer than four days which goes up to 86% when the hospital stay is more than six days ($P<0.05$).

DISCUSSION

Acute appendicitis is a major surgical emergency problem among children. Prompt decision prevents complications and deaths. The present study analysed the socio demographic characteristics, the clinical profile and the risk factors for perforation.

Appendicitis is found in all age groups which is in agreement with other studies. In the study by Harrison *et al* (3) the mean age was 8.5 years and only 5% of patients were less than two years of age. Similarly in a Nigerian study the age range was 3 to 14 years, the mean age being eight years (11). Appendicitis is found to have highest incidence in males (63.3%) than females (36.7%) which is consistent with many studies showing male predominance for which no apparent explanation could be given (1,2,10,11). The sex ratio is different from the report by Zelalern where the males are affected four fold. This difference may be related to the fact that the subjects in that study also included adults (19).

Though the mortality rate is similar to studies from other countries (7,10,12,18,) it is much lower than the local reports of 3.2% from the same hospital in an earlier study and 4% from Yirgalem Hospital (8,19). This may be due to the relatively better care at a tertiary hospital with better facility and skilled manpower.

The classic triads of fever, vomiting, and abdominal pain reported as the most important symptoms in this study were consistent with many studies. The important physical findings demonstrated include direct abdominal tenderness, and rebound tenderness and/or rigidity. In a Sudanese study (9) the main presenting features were; abdominal pain and tenderness, anorexia, nausea, vomiting and rebound tenderness. Fever was found in only 47% of the cases which is far lower than the finding in this study.

The following factors were found predictive for perforation in the univariate analysis; age <10 years, duration of symptoms at first presentation >24 hours, history of treatment elsewhere before arrival to Tikur Anbessa Specialised Hospital, the presence of generalised abdominal tenderness, rebound tenderness and/or rigidity RLQ mass, hypoactive and/or absent bowel sound, leukocytosis with predominant neutrophilia, and presence of complications (Table 2). Similar findings were found in many other studies (1,10,14,15). In the study by Ephrem and Desalegn (8) parental education of eight years or less was associated with perforation in contrast to this series where parental educational status had no effect. This difference could be related to the categorisation of subjects into literate and illiterate in this series.

The rate of perforation in this series is lower than an earlier report from the same hospital (8), 60.5%

from Yirgalem Hospital (19) and 41% from Gondar Hospital (20). The higher rate of perforations among under ten years old children may be due to misdiagnosis by health workers and/or parental delay in bringing the child to health care facility which was clearly demonstrated by the increased perforation rate in those with a positive history of treatment elsewhere before arrival. In general, the rate of perforation decreased with increasing age (1) similar to this series but Ephrem and Desalegn (8) could not find association of age with perforation.

Another important finding which was found to be highly predictive of perforation is the presence of leukocytosis with predominant neutrophilia. This is obviously because of generalised peritonitis and bacteremia associated with perforation. Similar findings were found in another study by Raftery (16). This data indicate that leukocytosis with neutrophilia is a common finding in appendicitis particularly with perforation and hence it is helpful as part of the routine investigations in these patients.

When taking all variables subjected to multiple logistic regression analysis, no single variable came out to be significant to predict the risk for perforation.

In the series by Harrison the length of hospitalisation was 3.6 ± 1.2 , 8 ± 2.6 , 18 ± 10.5 days for simple, advanced and complicated appendicitis respectively (3). In another study the average hospital stay was seven days (range 5-10 days) for perforated appendicitis with peritonitis (18). In a local study the length of hospital stay ranged from 1-36 days with a mean of 7.1 (Std 5.3) days (19). Longer hospital stay incurs heavy economic demand on the patient and the health care in general. Hence, prevention of perforation will have a significant impact in the health care.

Although the diagnosis of appendicitis is primarily clinical, certain laboratory works like WBC, differential count, C-reactive protein (CRP) and imaging studies like ultrasound of the abdomen and plain abdominal films have been shown to improve the diagnosis in equivocal cases. Raised CRP and leukocytosis of $>10,000/\text{mm}^3$ with $\geq 75\%$ neutrophils supports the diagnosis.

In the study by Raftery (16), 96% of his patients had an abnormal total and differential white cell count. In the series by Lee and Teoh, 63% of their patients had $\text{WBC} \geq 11,000/\text{mm}^3$ (7) while in another study a leukocytosis of $\geq 10,000/\text{mm}^3$ was found in 48% of patients (11).

In this study 25% of the patients had pyuria and haematuria. In an earlier study it has been asserted that inflammatory process of appendicitis may cause pyuria, haematuria or bacteriuria in as many as 40% of patients (21).

In conclusion, the clinical profile of this series is similar to earlier studies. No single factor that could predict perforation of appendicitis was found in this study. However, similar to other studies delay in intervention due to late presentation to hospital remains an important and preventable factor that requires attention for action.

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