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Appendicitis in children from 0 to 3 years in a general hospital of the second level. Five-year analysis (2013-2017)

Apendicitis en niños de 0 a 3 años en un hospital general de segundo nivel. Análisis de cinco años (2013-2017)

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Keywords:
Appendicitis, preschoolers, symptomatology, appendiceal perforation, mortality.

Palabras clave:
Apendicitis, preescolares, sintomatología, perforación apendicular, mortalidad.

ABSTRACT

Introduction: Acute appendicitis in children under three years of age is not frequent. **Material and methods:** To know the characteristics of patients with acute appendicitis in children under three years of age. An observational, descriptive, and cross-sectional study was carried out in a second-level general hospital. **Results:** During five years (January 2013 to December 2017), seven appendectomies were performed in children under three years of age; the common signs and symptoms were: tachycardia seven, whining five, nausea four, fever four, vomiting three. The averages were: age two years, clinical picture of four days, leukocytosis of 14,000/µl, neutrophils 25%, 52 lymphocytes/µl, and six days of stay. Macroscopic classification: three not perforated, two perforated, and one with peritonitis. **Mortality:** a case associated with Hirschsprung's disease. **Conclusions:** In this study, we found that tachycardia is a cardinal sign in pediatric patients with acute appendicitis. In the same way, general surgeons can take care of this group of patients when there is no viable alternative and the emergency is inevitable.

RESUMEN

Introducción: *La apendicitis aguda en niños menores de tres años no es frecuente.* ***Material y métodos:*** *Conocer las características de los pacientes menores de tres años con apendicitis aguda. Se realizó un estudio observacional, descriptivo y transversal en un hospital general de segundo nivel.* ***Resultados:*** *Durante cinco años (de enero de 2013 a diciembre de 2017) se realizaron siete apendicectomías en pacientes menores de tres años; los signos y síntomas frecuentes fueron: taquicardia en siete, quejumbre en cinco, náuseas en cuatro, fiebre en cuatro, y vómito en tres. Los promedios fueron: edad de dos años, cuadro clínico de cuatro días, leucocitosis de 14,000/µl, neutrófilos 25%, 52 linfocitos/µl y seis días de estancia. Clasificación macroscópica: tres casos de apéndice no perforado, dos casos de apéndice perforado, un caso con peritonitis, y un caso de apéndice sano.* ***Mortalidad:*** *un caso asociado con enfermedad de Hirschsprung.* ***Conclusiones:*** *Este estudio reveló que la taquicardia es el signo principal en los pacientes menores de tres años con apendicitis aguda. Del mismo modo, los cirujanos generales pueden atender a este grupo de pacientes cuando no haya alternativa viable y la emergencia sea absoluta.*

INTRODUCTION

Karaman, in a review of the English literature from 1901 to 2000, managed to collect 141 cases of appendicitis in children under three years of age, 75% males and 25% females; 52% of which were premature.[1]

The incidence of appendicitis varies according to the reference reviewed and rises from one to two cases per 10,000 children between birth and four years of age. It is also diagnosed in 1 to 8% of children presenting to the emergency department with acute abdominal pain.[2,3] It is more common in males than females at a ratio of 1.5 to 1.[4,5]

The assessment of abdominal pain in children is difficult and a thorough clinical

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evaluation may help diagnose cases of acute appendicitis in any of its phases. This evaluation can lead to two alternatives: 1) request assessment by a surgeon for suspected appendicitis and 2) in doubtful cases request complementary laboratory and cabinet studies. In children with abdominal pain, fever is the single most useful symptom for the diagnosis of acute appendicitis.[6] Premature infants have a high probability of having acute appendicitis.

Due to the young age, intraluminal obstruction of the appendix is not responsible for appendicitis, but other causes may lead to it such as a thromboembolic event, internal or external hernias, cardiac abnormalities and colon obstruction as in Hirschsprung's disease. Pain and nausea cannot be considered evidence of appendicitis in this age group, as these patients usually present with abdominal distention.

Because delay in diagnosis leads to perforation and peritonitis, caution should be exercised when dealing with this condition at this stage of life, as the younger the patient the greater the diagnostic difficulty.[7]

MATERIAL AND METHODS

To determine whether there are differences in the clinical picture, laboratory and imaging results, surgical technique, operating surgeons, morbidity and mortality in patients with acute appendicitis in children under three years of age, an observational, descriptive and cross-sectional study was conducted at a general hospital over a five-year period (2013 to 2017). Inclusion criteria: patients aged zero to three years with diagnosis of acute appendicitis operated by general surgeons or pediatric surgeons; both sexes; with complete clinical records. Exclusion criteria: all patients over three years of age with the same diagnosis and treatment or with incomplete records. Descriptive statistics were used for statistical analysis.

RESULTS

During the five-year study period (January 2013 to December 2017) seven (100%) appendectomies were performed on patients under the age of three; the classic signs and symptoms found were abdominal distention,

Table 1: Classic signs and symptoms reported in the literature in cases of acute appendicitis in children under three years of age.

Signs and symptoms	Neonates (%)	Infants < 2 years (%)	From 2 to 3 years (%)
Abdominal distention	60-90	30-52	85-90
Vomiting	59	85-90	—
Palpable mass	20-40	—	—
Irritation/lethargy	22	35/40	—
Cellulitis in the abdominal wall	12-16	—	—
Hypotension	√	—	—
Hypothermia	√	—	—
Rgidity of the ight hip	√	—	—
Breathing difficulty	√	—	35-81
Diffuse abdominal pain	—	35-77	40-60
Fever	—	40-60	18-46
Diarrhoea	—	18-46	—
Hypersensitivity	—	92	—
Pain localized to the right iliac fossa	—	< 50	—

(√) = may be present; (-) = absent.

Table 2: Demographic variables in cases of acute appendicitis in seven patients from zero to three years of age.

Cases			
Sex	**From 0 to 3 years**	**%**	
Male	4	57	
Female	3	43	
Total	7	100	
Time of evolution			
Hours	Cases	Days	Cases
8	1	1	2
		5	2
		6	1
		7	1
Image study			
Simple X-Ray of the abdomen in decubitus		Ultrasound	
5 (71%)		2 (29%)	
Ileus, sentry bowel loop		Free fluid and edema	
Pre-operative diagnosis			
Acute appendicitis		4 (57.4%)	
Abdominal sepsis		1 (14.2%)	
Intussusception		1 (14.2%)	
Abdominal Pain Syndrome		1 (14.2%)	
Total		**7 (100%)**	
Type of surgical incision			
Rocky-Davis	Median infra-umbilical	Transversal supra-umbilical	
3	2	2	
Surgeon			
Pediatric surgeon		General surgeon	
4		3	
Mortality			
A baby male (Hirschsprung's)			

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which was the most frequent in children under two years, vomiting, lethargy, diffuse abdominal pain in infants, and hypersensitivity *(Table 1)*; demographic variables are shown in *Table 2*; the frequent signs and symptoms were: tachycardia in seven cases (100%), whining in five (83%), nausea in four (67%), fever in four (67%), vomiting in three (50%) *(Table 3)*. The white cell count is presented in *Table 4*.

Statistical averages: two years of age, four-day duration of clinical picture, leukocytosis 14,000/μL, neutrophils 25%, lymphocytes/μL 52, and six days of in-hospital stay *(Table 5)*. Macroscopic classification: three cases of non-perforated appendix, two of a perforated appendix, one with peritonitis, and one patient of with healthy appendix *(Table 6)*. Mortality: one case of Hirschsprung's disease plus perforated appendicitis, sepsis, and multiple organ dysfunction syndrome (MODS). One case of intussusception with perforated appendicitis. Our youngest patient [(25 days of age, with (Hirschsprung's disease, the only death in the series)].

Table 4: White biometrics formula in seven patients with appendectomy (+, ++).

Case	Leukocytosis	Neutrophilia	Linfocitosis
1	15,000	88	8
2	3,700	29	68
3	12,700	67	27
4	16,200	77	19
5	19,600	82	2
6	9,300	33	30
7	21,700	68	25

+ Case 2 with postoperative diagnosis of mesenteric adenitis.
++ No C-reactive protein was requested in any case.

DISCUSSION

Acute appendicitis can occur at all stages of life, with a difficult diagnosis and high morbidity and mortality under the age of three, especially in the neonatal age. Its incidence is low, 0.04-0.2%, although it has a mortality rate of up to 28%. In our study, there was only one death (14%). In neonates, acute appendicitis should be considered in the differential diagnosis in cases of suspected abdominal sepsis in order to reduce complications.[8]

Neonatal appendicitis may occur as a solitary process or in association with various entities such as Hirschsprung's disease, as in our case, incarcerated or non-incarcerated inguinal hernia, congenital heart disease, necrotizing enteritis, cystic fibrosis, umbilical hernia, pneumonia, chorioamnionitis, mucormycosis, esophageal atresia and tracheoesophageal fistula, Patau's syndrome, meconium ileus, idiopathic colon perforation, and infections, among others. History of cesarean section for placental abruption and preeclampsia has also been reported.[9] In this series, we had one case with Hirschsprung's disease, perforated appendix, sepsis, and multiple organ failure (MOF) without any of the other associations reported in the literature.

Table 3: Common signs and symptoms in cases of acute appendicitis in seven patients aged zero to three years.

Symptom/sign	Cases	%
Tachycardia	7	100
Complaining	5	83
Nausea	4	67
Fever	4	67
Vomiting	3	50
Abdominal distention	3	50
Dehydration	3	50
Diarrhea	3	50
Blood per rectum	1	17

The clinical presentation is subtle and nonspecific, with anorexia, vomiting, diarrhea, and abdominal distention. There are two types of clinical presentation: 1) intra-abdominal (66-75%) and 2) intra-hernial (25-33%). The first is frequently confused with necrotizing enterocolitis, which delays diagnosis and increases perforation and peritonitis, and consequently, mortality; the second presentation is easier to diagnose and has a better prognosis.[10,11] López-Valdés JC et al.[12] report a case of neonatal appendicitis associated with necrotizing enterocolitis. All our cases were intra-abdominal.

Kamphuis SJ et al.[13] reported two cases of female patients aged eight months and three years, who presented with dehydration, vomiting, and fever, both cases with a perforated appendix. Schwartz KL et al.[14] have proposed an algorithm to facilitate early diagnosis in

neonates with acute appendicitis, which will have to be validated over time. Of all children with appendicitis, 2.3% to 5.4% are younger than three years of age, and although the incidence does not appear high, delay in diagnosis carries risks, with a perforation rate of 50-100%. Of the seven cases in this age group three had perforation (50%), as reported in the literature.

In children under three years of age, symptoms such as vomiting occur (85-90%), pain (35-81%), fever (40-60%), diarrhea (18-46%), irritability (35-40%), cough or rhinitis (40%), breathing with rales (8-23%), restriction of mobility of the right hip, pain and limping (3-23%). On physical examination, most children have a fever greater than 37 ºC (87-100%), peritoneal irritation (55-92%); localized pain in the right iliac fossa is seen in less than 50% of cases. Other important signs are lethargy (40%), abdominal distension (30-52%), abdominal rigidity (23%), and palpable abdominal or rectal mass (30%). The most frequent signs and symptoms in children under three years were abdominal pain, vomiting and fever (83, 75.5 and 67%), and increased muscular tone with abdominal distension.[15]

Baglaj M et al.[16] analyzed 53 cases of children under three years of age during 20 years, whose main symptoms were: abdominal pain, vomiting, and fever with a perforation percentage of 24.5%. Barker AP et al.[17] showed a gangrenous or perforated appendix in 92% of the cases and emphasized the cases of children under three years of age with fever, vomiting, abdominal pain, and signs of peritoneal irritation. Positive diagnostic aids are very important. Alloo J et al.[18] detected that the frequent symptoms were: vomiting, fever, pain, anorexia and diarrhea, and common signs were: abdominal hypersensitivity, peritonitis, fever > 38 ºC or more, abdominal distension, leukocytosis < 12,000/mm^3, hypersensitivity in the right iliac fossa or diffuse hypersensitivity, simple abdominal radiography with data of intestinal obstruction, fecalith and pneumoperitoneum with perforation in all patients. On the other hand, this pathology can also present in an insidious way as is the case with acute urinary retention.[19]

Daehlin[20] observed in 49 cases that symptoms are common, and recommends urinanalysis as well as leukocyte count. In their study radiology was useful in 78% of the cases. However, the delay in diagnosis was of 43%, perforation in 79%, and complications in 18%, with no mortality. In our study we found six main signs: tachycardia, five cases (23%); whining, five cases (23%); nausea, four cases (18%); vomiting, three cases (14%); fever, four cases (18%), and abdominal distension in three cases (14%).

Nance ML et al.[21] noted that at the time of surgery, 74% of patients had evidence of perforation, and the range increased as patient age decreased (100% perforation by age one year to 69% by age five), associated with a longer hospital stay, with an average of nine days, as we did in this series, with prolonged hospital

Table 5: Statistical analysis in seven patients aged zero to three years with acute appendicitis.

Values	Age (years)	Clinical evolution (days)	Leukocytes/µl	Neutrophils (%)	Lymphocytes/µl	DIHS
Mean	2	4	14,000	25	52	6
Median	2	5	15,000	16	67	4
Mode	2	1	—	—	—	3
SD	2	3	6	28	29	5
Minimum	25 days	1	4,000	4	8	2
Maximum	3	7	22,000	88	84	15

DIHS = Days of in-hospital stay.

Table 6: Macroscopic classification in appendix cases in seven patients from zero to three years of age.

Macroscopic appearance of the appendix			Grade	Cases
Classification	From 0 to 3 years	%	0	1
Non-perforated appendix	3	44	I	2
Perforated appendix	2	28	II	0
Perforated appendix with peritonitis	1	14	III	1
Healthy appendix	1	14	IV	3
Total	7	100	Total	7

stays in cases with perforated appendicitis or frank peritonitis.

Skellaris et al.[22] in an 11 year period operated 122 cases of appendicitis in children under five years, with 52% of perforated appendices. Our study revealed a 14% perforation rate in the one to three-year-old group with generalized peritonitis (5%). In our setting, this entity is not frequent, as we had only seven cases in five years. Orozco-Sanchez J et al.[23] in their case study of 72 cases found as main clinical signs: fever, vomiting, abdominal pain, and distension. The incision was a paramedian right supra- and infra-umbilical, unlike our cases, where the Rocky-Davies type was used, median infra-umbilical and transverse supra-umbilical were used in one case. The Rocky-Davies incision and the infra-umbilical median incision were the most used by general surgeons and the transversal ones by pediatric surgeons.

As far as laparoscopic surgery is concerned, no patient has been operated on by this technique in our series, although many studies have shown its feasibility.[24] Children under three years of age have not yet been operated using this surgical modality in our hospital. In this series, there was only one of death, a newborn (25 days old), with Hirschsprung's disease and perforated appendicitis, sepsis, and MOF.

The lack of pediatric surgeons in many hospitals means that general surgeons attend to this group of patients; in the study by Da Silva et al.[25] differences were observed in terms of complications when treated by general surgeons. In our case, we had about 50% of surgical interventions by these specialists and there was no difference in the final results.

CONCLUSIONS

The clinical picture of all patients revealed that tachycardia is the main sign. The in-hospital stay was prolonged due to the delay between the onset of symptoms and their treatment.

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