

Time Between Onset of Symptoms and Definitive Treatment in Children with Acute Appendicitis: How it Affects Length of Hospital Stay?

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Abstract

Purpose: Any delay in treatment of acute appendicitis (AA) could lead to complications increasing morbidity and length of hospital stay (LHS). The aim of this study was to determine the time interval between onset of symptoms and seeking medical attention and definitive treatment in children with AA and its impact on LHS. **Materials and Methods:** A prospective study was conducted from December 2017 to March 2018. All patients diagnosed with AA and who underwent surgical procedure were enrolled. A questionnaire leaflet completed by parents was used to collect clinical data and information about seeking medical attention and children's management. Time was divided into six different intervals (1–2 h, 3–6 h, 7–12 h, 13–24 h, >24 h and >48 h) to estimate the time between onset of symptoms and seeking medical attention and time between hospital admission and surgical procedure. LHS was recorded. **Results:** During the study period, 125 children were enrolled. Over half of the patients sought for medical assistance relatively soon (3–12 h) after the onset of symptoms, whereas 17.6% sought late healthcare (>24 h). The time between the medical examination and surgical procedure was <24 h in approximately 80% of the children. LHS was affected by time between onset of symptoms and seeking medical attention and time between medical examination and surgical procedure ($P = 0.001$ and $P = 0.017$, respectively). **Conclusions:** The majority of the children with AA admitted to hospital were treated relatively soon after the onset of symptoms. However, a significant proportion of children delayed to seek medical advice and undergo appendectomy, increasing LHS.

Keywords: Appendicitis, children, length of hospital stay, symptoms, time

INTRODUCTION

Acute appendicitis (AA) is the most common cause of acute abdomen in children, which if left untreated, can lead to serious life-threatening complications.^[1-3]

Timing of effective treatment of AA is extremely important for clinical outcome, as any delay could lead to complications that increase patient morbidity, duration of hospital stay and healthcare costs. The objective of this study was to determine the time interval between onset of symptoms and seeking medical attention and definitive treatment in children with AA and the impact of the delay of treatment

on the length of hospital stay (LHS) and identify targets for future intervention.

MATERIALS AND METHODS

Study design, setting and population

A prospective study was undertaken between December 2017 and March 2018 in the Department of Paediatric Surgery of

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P. & A. Children's Hospital, in Athens, Greece. Totally 125 children diagnosed with AA (uncomplicated and complicated) and subjected to surgical procedure were eligible to be included in our study. Complicated AA was defined as perforated appendicitis, periappendicular abscess or peritonitis.

The study was approved by the P. & A. Children's Hospital's Research Ethics Committee (chairperson: Emmanouil Papisavvas, protocol number: 21/14.12.2017, date of approval: 14 December, 2017) and was conducted in accordance with the principles set forth in the Helsinki Declaration. Data collection was performed after written permission from the hospital's Scientific Council. Moreover, criterion for the participation in the study was the obtaining of a signed informed consent form, which was written in Greek language easily understood by the parents. Children, whose parents did not have good knowledge of Greek language, did not consent or suffered from severe cognitive dysfunction, were excluded.

Data collection

To capture data, we designed an anonymous questionnaire leaflet completed by the parents of the hospitalised children. The questionnaire consisted of three parts: (1) questions on sociodemographic characteristics of parents and patients, (2) questions about the presentation of clinical symptoms and information about seeking medical attention (initial symptoms, administration of analgesics before seeking medical help, time interval between onset of symptoms and seeking medical attention, the way of seeking help and means of transfer to the hospital) and (3) questions regarding the clinical examination and in-hospital management (waiting time from arrival to the hospital until medical examination, the speciality of the doctor who performed first examination, laboratory and imaging tests and time interval between hospital admission and surgical procedure).

Data analysis

We divided time into six different intervals (1–2 h, 3–6 h, 7–12 h, 13–24 h, >24 h and >48 h) to estimate the time between onset of symptoms and seeking medical attention and time between hospital admission and surgical procedure. Finally, LHS was recorded.

Statistical analysis

Categorical variables were summarised as absolute and relative (%) frequencies. Associations between categorical variables were tested using the Chi-square test. All reported *P* values were based on two-sided hypotheses and compared to a significant level of 5%.

RESULTS

Table 1 presents the baseline characteristics of patients and data about parental decision-making of seeking medical assistance. Regarding symptoms, abdominal pain was the most common symptom alone (48%) or in combination with anorexia, nausea-vomiting and fever. The vast majority (90.4%) of the parents did not administer analgesics before seeking for

Table 1: Patient's characteristics

Patients' characteristics	<i>n</i> =125, <i>n</i> (%)
Gender	
Male	81 (64.8)
Female	44 (35.2)
Age (years)	
2-5	9 (7.2)
6-11	76 (60.8)
12-16	40 (32)
Parent*	
Mother	100 (80)
Father	25 (20)
Parent's age (years) [†]	
26-45	101 (80.8)
46-65	24 (19.2)
Parent's occupation [†]	
State employees	29 (23.2)
Private employees	45 (36)
Freelancers	21 (16.8)
Household occupants	18 (4)
Unemployed	12 (9.6)
Parent's educational level [†]	
Illiterate	3 (2.4)
Secondary education	72 (57.6)
Tertiary education	43 (34.4)
Master/PhD	3 (2.4)
Complaints-symptoms	
Abdominal pain	60 (48)
Appetite loss	2 (1.6)
Nausea/vomiting	1 (0.8)
Fever	2 (1.6)
Abdominal pain + appetite loss	10 (8)
Abdominal pain + nausea/vomiting	20 (16)
Abdominal pain + fever	5 (4)
Abdominal pain + appetite loss + nausea/vomiting	8 (6.4)
Abdominal pain + appetite loss + fever	4 (3.2)
All the above	6 (4.8)
Analgesic administration (Yes)	12 (9.6)
Residence	
Athens	85 (68)
Other	40 (32)
Complicated appendicitis (Yes)	31 (24.8)

[†]The parent who completed the questionnaire

medical help and 31 children (24.8%) were diagnosed with complicated AA [Table 1].

Table 2 presents data about parental decision-making on when and how to seek for medical care for their acutely sick child. Over half of the participants sought medical attention 3–12 h after the onset of symptoms, 10.4% after >24 h, while 7.2% after >2 days. Approximately half of the parents (49.6%) chose to visit immediately the emergency department (ED), followed by those who transfer their child to the nearest municipal health clinic or health centre (12%) and those who firstly telephone the paediatrician or family doctor and then transfer their child to the hospital (12%) [Table 2]. The fewest parents (0.8%)

Table 2: Parental decision-making of seeking medical assistance

	n=125
Time between onset of symptoms and seeking medical care (h)	
1-2	10 (8)
3-6	41 (32.8)
7-12	29 (23.2)
13-24	23 (18.4)
>24	13 (10.4)
>48	9 (7.2)
Ways of seeking medical care	
Telephone the paediatrician or family doctor	13 (10.4)
Visit the paediatrician	10 (8)
Transport of the child to the nearest municipal health clinic or health centre	15 (12)
Visit the Emergency Department of a hospital	62 (49.6)
Telephone the paediatrician or family doctor and transport of the child to the nearest municipal health clinic or health centre	2 (1.6)
Telephone the paediatrician or family doctor and visit the Emergency Department of a hospital	15 (12)
Visit the paediatrician and visit the Emergency Department of a hospital	2 (1.6)
Transport of the child to the nearest municipal health clinic or health centre and visit the Emergency Department of a hospital	3 (2.4)
Telephone the paediatrician or family doctor, visit the paediatrician and visit the Emergency Department of a hospital	2 (1.6)
Visit the paediatrician, transport of the child to the nearest municipal health clinic or health centre and visit the Emergency Department of a hospital	1 (0.8)
Transport to the hospital by	
Private vehicle	115 (92)
Ambulance	8 (6.4)
Public transport	2 (1.6)

Table 3: Distribution of the sample according to the management of the patients at the hospital

	n=125, n (%)
Time between arrival at hospital and medical examination	
Immediately	66 (52.8)
<1 h	32 (25.6)
1-3 h	18 (14.4)
>3 h	9 (7.2)
The initial examination was performed by	
Paediatrician	72 (57.6)
Surgeon	53 (42.4)
Diagnostic tests	
Blood tests (yes)	117 (93.6)
Abdominal X-ray (yes)	62 (49.6)
Abdominal ultrasound (yes)	73 (58.4)
Time between medical examination in outpatient basis and surgical procedure (h)	
1-2	9 (7.2)
3-6	14 (11.2)
7-12	43 (34.4)
13-24	36 (28.8)
>24	19 (15.2)
>48	4 (3.2)

decided in the beginning to visit the paediatrician, then they transferred the child to the nearest municipal health clinic or health centre and eventually they went to the hospital. Moreover, the overwhelming majority of the children (92%) were transferred to the hospital by private vehicle [Table 2].

Regarding the time elapsed from arrival at hospital until clinical examination, Table 3 shows that more than half of the children (52.8%) were examined immediately upon arrival at the hospital, followed by those, who examined in <1 h (25.6%). Only 7.2% declared that waiting time was >3 h. Furthermore, the largest proportion of the children (57.6%) was initially examined by a paediatrician [Table 3]. The vast majority of the children underwent blood tests (93.6%), about half of the children (49.6%) underwent an abdominal X-ray and 58.4% underwent an abdominal ultrasound examination. Concerning the estimated time between medical examination in outpatient basis and performance of surgical procedure, only 7.2% and 11.2% of the patients were operated in 1–2 h and 3–6 h after initial examination, respectively. Most of the children underwent a procedure in 7–12 h (34.4%) and in 13–24 h (28.8%) after medical examination. In addition, 15.2% and 3.2% of the children underwent an appendectomy in >1 day and >2 days, respectively [Table 3]. Finally, the overall mean LHS was 5.22 days (standard deviation ± 2.07).

Stratified analyses by patients' characteristics, parental decision-making of seeking medical assistance and the management of the children at the hospital revealed that LHS was significantly affected from region of residence ($P = 0.012$), the time between onset of symptoms and seeking medical attention ($P < 0.001$) and time between clinical evaluation in outpatient basis and surgical procedure ($P = 0.017$). Among laboratory and radiological examinations, only abdominal X-ray was associated with prolonged hospital

stay ($P = 0.033$). Finally, children with complicated appendicitis were significant more likely to be hospitalised for much longer period of time than those with uncomplicated appendicitis ($P < 0.001$) [Table 4].

Table 4: Length of hospital stay by patients' characteristics, parental decision-making of seeking medical assistance and the management of the children at the hospital

	Length of hospital stay (days) (M±SD)	P
Gender		
Male	5.23±1.89	0.486
Female	5.18±2.38	
Age (years)		0.537
2-5	6.22±2.86	
6-11	5.21±2.07	
12-16	5.00±1.84	
Parent's educational level*		P=0.721
Illiterate	5.33±1.53	
Secondary education	5.28±1.89	
Tertiary education	4.98±2.35	
Master/PhD	6.00±2.38	
Analgesic administration		0.984
Yes	5.33±2.19	
No	5.20±2.07	
Residence		0.012
Athens	4.89±1.79	
Other	5.90±2.45	
Time between onset of symptoms and seeking medical care (h)		0.001
1-2	5.07±1.94	
3-6	4.47±1.39	
7-12	4.79±1.52	
<24	5.60±2.38	
>24	6.85±2.60	
Time between arrival at hospital and medical examination		0.846
Immediately	5.09±1.93	
<1 h	5.53±2.59	
1-3 h	5.11±1.49	
>3 h	5.22±2.22	
Diagnostic tests		
Blood tests		0.018
Yes	5.16±2.08	
No	6.00±1.77	
Abdominal X-ray		0.033
Yes	5.42±1.82	
No	5.02±2.82	
Abdominal ultrasound		0.304
Yes	5.30±1.99	
No	5.10±2.19	
Time between medical examination in outpatient basis and surgical procedure (h)		0.017
1-2	4.78±1.79	
3-6	4.93±1.44	
7-12	4.65±1.66	
13-24	5.28±1.98	
>24	6.00±2.08	
>48	9.00±4.55	
Complicated appendicitis		<0.001
Yes	8.10±2.06	
No	4.27±0.82	

SD: Standard deviation, M: Median

DISCUSSION

Time between onset of symptoms and seeking medical attention and definitive treatment is an essential prognostic factor of AA and affects the postoperative course of patients, as a significant delay of treatment increases the risk for developing complicated appendicitis.^[3-7]

The main goal of our study was to investigate how soon parents of children with AA seek for medical help after the first appearance of symptoms. Specifically during the study period, over half of the patients sought for medical assistance relatively soon (3–12 h) after the onset of symptoms. On the other hand, almost one-fifth of the children sought late healthcare (>24 h), as a 24–48 h delay to medical examination raises the incidence of complicated appendicitis.^[3,7]

In addition, transport of children to ED was the first choice of most parents, using their private vehicle. Except for pre-hospital management and delay, which affects the outcome of children with AA, their prompt and appropriate in-hospital management is also essential for avoiding potential complications.^[8,9] Furthermore, delays in definitive treatment of AA may be related to extensive diagnostic work-up.^[10] In our study, during ED evaluation, the largest proportion of children was examined within 1 h after hospital admission mainly by a paediatrician, underwent blood tests, over half of them underwent abdominal ultrasound scan, whereas no patient underwent computed tomography. Finally, the time between medical examination in outpatient basis and surgical procedure was <24 h in approximately 80% of the children. This finding is important, as current evidence supports that appendectomy performed within the first 24 h from presentation is not associated with increased risk of complicated appendicitis.^[6,7,9]

In the present study, we evaluated the association between LHS and time from onset of symptoms to seeking medical care and appendectomy and tried to explore the relationship between increased LHS and some patients' characteristics and management strategies in ED. More specifically, patient residence was found to be potentiating factor for longer LHS, as children's LHS, who did not live in Athens, was longer. This finding could be potentially attributed to the larger travel distance required for patients living in rural areas to reach the nearest high-volume hospital, resulting in treatment delay. Notably, children, whose parents sought for medical advice soon were much more likely to stay at hospital fewer days than those whose parents, were late. This finding is consistent with other studies demonstrating that increased time between onset of symptoms and surgical treatment may be a predictive factor of complicated appendicitis, leading to prolonged hospitalisation.^[7] On the other hand, our results demonstrate that LHS was irrespective of in-hospital timing to medical examination, whereas the time between medical examination and surgical procedure affected LHS. In details, children who experienced delay >12 h stayed at hospital longer, compared to those who underwent appendectomy in <12 h, as published studies have indicated that long-time delays from

initial evaluation to surgical procedure increase the risk of complicated appendicitis.^[3,8,9]

According to our results, additional driver for extended LHS was the performance of an abdominal X-ray during acute abdominal pain evaluation, as it has been found that obtaining abdominal radiographs are associated with frequent misdiagnoses.^[11] Finally, similarly to other studies, our study revealed that LHS of children diagnosed with complicated appendicitis was two-fold longer compared to those presented with uncomplicated appendicitis.^[12-15]

A limitation of our study was the fact that it was conducted at a single, tertiary-care centre, which may limit the generalisability of our findings. However, because it includes patients with variant characteristics, we believe our findings could provide valuable information in the medical community seeking to develop strategies to reduce delays in treatment of AA in children.

CONCLUSIONS

Our study demonstrates that the majority of the children with AA admitted to ED were treated relatively soon after onset of symptoms. However, a significant proportion of study participants delayed to seek medical advice and undergo appendectomy, increasing the risk of complicated appendicitis and LHS. Moreover, the performance of unnecessary radiological tests during medical evaluation and long-time delay from initial examination to surgical procedure has negative impact on LHS. Hence, time matters and we should design and implement interventions to alter our current practices and educate parents regarding the management of children suspected of AA.

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Conflicts of interest

There are no conflicts of interest.

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