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Influence of Appendectomy Timing in the Pathological Outcome and the Morbidity of Acute Appendicitis in Children: A Retrospective Study

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Abstract

Introduction: Surgery is indicated for acute appendicitis but there is controversy regarding precise timing for appendectomy.

Objective: Our aim was to evaluate the impact of time delay from emergency department presentation to surgery in developing complicated appendicitis in children and associated morbidity.

Methods: 540 charts of children, who underwent appendectomy, between January 2013 and December 2016 were retrospectively reviewed. Groups were divided by time of intervention. Group 1: less than 24h (n=209, 38.7%), group 2: 24h to 48h (n=293, 54.5%), and group 3: greater than 48h (n=38, 6.8%). We considered complicated appendicitis gangrenous, abscess or perforated appendix per operatively and on histopathologic examination. Statically analysis and was performed to search the predictors of complicated appendicitis and evaluate post-operative complications.

Results: Among 540 children included in the study, 164 (30.4%) had complicated acute appendicitis. There was no correlation between delay to surgery and the risk of developing a complicated form of the disease for group 1 and Group 2. Beyond the 48th h (group 3), the rate of developing complicated appendicitis and post-operative complications increased significantly. Hospital stay was not affected by delayed surgery.

Conclusion: A short in-hospital delay before surgery less than 48 h, for acute appendicitis in child, is not associated with an increased rate of complex appendicitis neither associated morbidity.

Keywords Appendicitis; Delay surgery; Child; Complication; Morbidity

Introduction

Acute appendicitis is the commonest pediatric abdominal surgical emergency. Although new trials suggest antibiotic therapy alone is sufficient for acute simple appendicitis, surgery remains the gold standard [1,2]. Recent studies suggest that after antibiotics therapy has been initiated, appendicitis can be managed with a semi elective strategy [3,4]. Some studies report that delayed appendectomy in the daytime may offer better work environment [5]. However, others report that it increases the risk of advanced pathological forms [6,7]. This study aims to evaluate the impact of interval of appendectomy in developing complex appendicitis and post-operative complications in children.

Materials and Methods

A retrospective review of all patients who underwent emergency appendectomy with the intention to treat clinically suspected appendicitis between January 2013 and December 2016 at our centre was undertaken. Demographic data, use of antibiotics before surgery, interval of appendectomy, surgical approach (open vs. laparoscopic), outcomes, pathological examination of appendix and hospital stay. Interval of appendectomy was defined as time from admission in the emergency department until time of incision. Complex appendicitis was defined as gangrenous, abscessed or perforated appendix on per operative findings and pathological examination.

The morbidity was evaluated by the length of hospital stay and post-operative complications. Post-operative complications were defined as development of surgical site infection, intra-abdominal abscess, or sepsis until 30 days after discharge.

All patients were separated in 3 groups according to the interval of appendectomy. Group 1: less than 24 h (n=209, 38.7%), group 2: 24 h to 48 h (n=293, 54.5%), and group 3: greater than 48h (n=38, 6.8%). Characteristics of patients who had simple appendicitis were compared with those who had complicated appendicitis. We estimated predictors of complicated appendicitis using. Association between surgical

delay and the risk of developing complicated appendicitis and morbidity were studied. All tests were carried out using $p < 0.05$ as the significance level.

Results

Between January 2013 and December 2016, 540 patients underwent appendectomy with the intention to treat clinically suspected appendicitis at our centre. There were 309 male

(57.3%) and 231 female (42.7%). The Mean of age was 9.23 ± 2.78 years. Of all patients, 316 (58.5%) were presented simple appendicitis, 164 patients (30.4%) had complicated appendicitis, and 60 patients (11.1%) presented a normal appendix.

Differences between patients with simple and complex appendicitis are shown in **Table 1**. Gender ($p=0.407$), delay to operation ($p=0.096$) and operative method ($p=0.973$) were not correlated to complex appendicitis.

Table 1: Comparisons between patients with simple appendicitis and patients with complicated appendicitis.

Characteristics of patients	Simple appendicitis (316)		Complex appendicitis (164)		p-value
Gender					
Male	182	58.20%	104	63.40%	0.407
Female	134	41.80%	60	36.60%	
Temperature $\geq 38.5^\circ\text{C}$					
Yes	190	60.10%	136	82.90%	<0.001
No	126	39.90%	28	17.10%	
Operative method					
Open	233	73.80%	120	73.20%	0.973
Laparoscopic	83	26.20%	44	26.80%	
Delay to operation					
<24 h	127	40.20%	57	34.70%	
24-48 h	175	55.30%	83	50.60%	0.096
>48 h	14	4.50%	24	14.70%	
Antibiotics before surgery					
Yes	131	41.40%	104	63.40%	0.027
No	185	58.60%	60	36.60%	
Post-operative complications					
Yes	11	3.40%	23	14.00%	0.003
No	305	96.60%	141	86.00%	
Hospital stay (days)					
$\leq 2j$	214	67.70%	23	14.00%	
$> 2j$	102	32.30%	141	86.00%	<0.001

Patient with complex appendicitis received more ATB and had longer hospital stay in hospital. Temperature in admission $\geq 38.5^\circ\text{C}$ was significantly associated with complicated appendicitis ($p < 0.001$).

Differences between patients who underwent surgery at <24, 24-48 and >48 h are shown in **Table 2**. Those with longer delays to operation were more likely to receive more antibiotics ($p < 0.001$). Hospital stay and post-operative complications were

not significantly associated with delayed appendectomy ($p=0.735$ and $p=0.648$ respectively). There was also, no significant association between delay to operation and rate of complex appendicitis. When divided in three groups (**Table 3**), the rate of complex appendicitis increased significantly when surgery was done after 48 h; group 1 [odds ratio (OR)=0.786, $p=0.362$], group 2 [OR=0.849, $p=0.793$] and group 3 [OR=3.615, $p=0.023$]. Also postoperative complications increased if child underwent surgery after 48h from admission; group 1

[OR=0.762, p= 0.665], group 2 [OR=0.407, p=0.142] and group 3 [OR=8.909, p<0.001].

Table 2: Characteristics of Patients by the interval of appendectomy.

Characteristics of patients	<24 h (209)		24-48 h (293)		>48 h (38)		p-value
Gender							
Male	99	47.30%	183	62.40%	30	80%	0.316
female	110	52.70%	110	37.60%	8	20%	
Operative method							
Open	150	71.80%	221	75.40%	28	73.60%	0.691
Laparoscopic	59	28.20%	72	24.60%	10	26.30%	
Histology							
Simple	160	76.50%	221	75.40%	18	47.30%	0.827
Complex	49	23.30%	72	24.60%	20	52.70%	
Antibiotics before surgery							
Yes	29	14%	215	73.40%	23	60%	<0.001
No	280	86%	78	26.60%	15	40%	
Post-operative complications							
Yes	10	4.80%	10	3.40%	13	34.20%	0.648
No	199	95.20%	283	96.60%	25	66.80%	
Hospital stay (day)							
<=2j	85	40.60%	135	46.40%	28	73.60%	0.735
>2j	124	59.40%	157	53.60%	10	26.30%	

Table 3: Correlation between delay to surgery and complicated appendicitis and correlation between delay to surgery and post-operative complications.

Variables	OR	p- value
Complex appendicitis		
Group 1 (<24 h)	0.786	0.362
Group 2 (24-48 h)	0.849	0.793
Group 3 (>48 h)	3,615	0.023
Post-operative complications		
Group 1 (<24 h)	0.762	0.665
Group 2 (24-48 h)	0.407	0.142
Group 3 (>48 h)	8.909	<0.001

Discussion

Acute appendicitis has been the commonest abdominal surgical emergency requiring operation for both adults and children. Age may be a potential for selection bias when study is

interested by both adults and children. In fact, Hornbay et al. found that children underwent appendectomy more quickly than elderly because of difficulty of diagnosis in the aged group [8]. In another study, early intervention was most likely to be performed on younger patients with fewer pre-existing comorbidities [3]. In literature, only six pediatric studies were reported, correlating time to surgery with perforated rate. Results are controversial [9]. In this study, we report our own experience devoted only to pediatric population.

Some papers suggest that appendectomy should be considered as an urgent procedure to prevent complications and morbidity [10], especially in a developing country [10,11]. However, trials of successful no operative management of uncomplicated appendicitis have suggested that short delay before appendectomy may be feasible [12,13]. Although there is evidence to support delay of surgery, it is not well established what this interval should be. Some authors found that even short delays of 6 to 12 h may result on increasing surgical site infections [5]. Others found no increased rate of complicated appendicitis if time to operation was less than 48 h [6]. Brett et al. suggest that patients who are diagnosed with acute appendicitis at night can be managed no operatively until

surgery can be scheduled at a more convenient time [3]. A study focusing on the pediatric population, confirmed the safety of delaying appendectomy until the following morning when patients are admitted late in the evening [14]. There was no association between surgical site infection rates and delayed surgery [14]. Our study supports a safe delay of appendectomy for children less than 48 h.

For Shin et al. [15] clinical outcomes of delayed appendectomy were not superior to those of early appendectomy. Findings in Chen et al. study, demonstrated that delay of appendectomy more than 8 h after admission, did not increase the appendix perforation and postoperative complication rate [4]. Hornby et al. found that a delay to surgery less than 48 h does not influence the pathologic outcome of acute appendicitis [8]. Our study supports these findings and unlike Texiera et al. study [5], surgical site infection didn't increase if delayed surgery less than 48 h.

The strengths of this study are that it focus on pediatric population, done in a developing country where disease presents generally late and reviewed at the same time the impact of interval off appendectomy on pathological outcomes and postoperative complications.

Conclusion

The main finding of our study was that a short delay of appendectomy less than 48 h does not increase rate of complex appendicitis neither morbidity even in children living in developing countries.

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