



Pediatric appendicitis and need for antibiotics at time of discharge: Does route of administration matter?



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ABSTRACT

Introduction: Following complicated appendicitis, there are limited data available to guide the surgeon regarding antibiotic selection, specifically in regards to route of administration. We hypothesized that among children with appendicitis who are discharged home with antibiotic therapy, the post-discharge readmission and complication rates do not differ between those children who receive IV antibiotics and those who receive PO antibiotics.

Methods: We performed a retrospective review of all children discharged home on antibiotics following appendectomy at a single institution between 11/10–10/14. We compared outcomes including ED and hospital readmission rates, and development of postoperative complications, between those children who were discharged on IV antibiotics and those discharged on PO antibiotics.

Results: 325 children were discharged with antibiotics following appendectomy ($n = 291$ PO antibiotics group; $n = 34$ IV group). On both univariate and multivariate analysis, rate of each complication did not differ between the two groups including inpatient readmission (5% PO vs. 6% IV; $p = 0.8$), ED readmission (10% vs. 11%; $p = 0.8$), postdischarge complications related to the operation (10% vs. 15%; $p = 0.4$), or abscess development post-discharge (4% vs. 3%; $p = 1$).

Conclusions: Among children with complicated appendicitis who are discharged home with ongoing antibiotic therapy, our data demonstrate no differences in outcomes between those children who receive IV and PO antibiotics. Further data, collected in a prospective fashion, are needed to clarify the role of IV and PO antibiotics among children with perforated appendicitis.

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Acute appendicitis is the most common surgical disease managed in the pediatric population [1]. Many of these children present with perforated or complicated appendicitis. Although precise definitions of complicated appendicitis may vary between surgeons and hospitals [2], it is the standard of care to treat those children with ongoing antibiotic therapy after appendectomy [3]. However, the choice of specific antibiotic, route of administration, whether they be given intravenously (IV) or orally (PO), as well as duration of therapy is based mainly on an

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individual surgeon's preference and experience, with little data available to help guide decision making [1,2,4,5]. Previous data demonstrate that many surgeons treat these children with IV antibiotic therapy in the immediate postoperative period and continue treatment with PO antibiotics following hospital discharge [6–9]. Data from the orthopedic literature demonstrate higher complication rates among children who receive home IV antibiotics, compared to children on only oral antibiotics [10]. Looking specifically at appendicitis, previous data compared an IV plus PO regimen to an exclusive IV regimen among children with perforated appendicitis and demonstrated treatment equivalence [8]. However, this study was done at the time of triple antibiotic therapy for pediatric appendicitis, which has now been replaced with once daily dosing of ceftriaxone and metronidazole [2]. Given this change in antibiotic management, as well as the persistent use of home IV antibiotics among children with perforated appendicitis, we aimed to perform a retrospective review of data from a single institution to evaluate differences in outcomes among children with appendicitis who are

Table 1
Demographic characteristics.

	Total	PO n = 291	IV n = 34	P value
Male, n(%)	188 (58%)	169 (58%)	19 (56%)	0.81
Age, Mean(Std)	9.6 (4.2)	9.7 (4.1)	8.9 (4.5)	0.34
Initial Complications, n(%)	69 (21%)	47 (16%)	22 (65%)	<0.0001
Specific antibiotic used at home, n(%)				<.0001
amoxicillin/clavulanate or ampicillin/sulbactam	204 (64.7%)	203 (70.2%)	1 (3.7%)	
ciprofloxacin	1 (0.3%)	1 (0.3%)	0 (0%)	
ciprofloxacin + metronidazole	75 (24%)	73 (25.3%)	2 (7.3%)	
All others	36 (11%)	12 (4.2%)	24 (89%)	
Length of stay in days, Mean(Std)	5.5 (2.8)	5.0 (2.4)	9.6 (3.2)	<0.0001
Days of therapy on home antibiotics, Mean(Std)	6.4 (2.5)	6.1 (2.0)	9.2 (4.3)	0.0003

discharged home on PO vs. IV antibiotic therapy. We hypothesized that among children with appendicitis who are discharged home with antibiotic therapy, the post-discharge readmission and complication rates do not differ between those children who receive IV antibiotics and those who receive PO antibiotics.

1. Materials and methods

Following approval of the Colorado Multiple Institutional Review Board, we performed a retrospective review of all children discharged home on antibiotics following appendectomy for acute appendicitis at a single institution between 11/10–10/14. A list of all children who underwent appendectomy during this time was obtained from the operating room database. We included only those children who underwent appendectomy for a diagnosis of acute appendicitis. Exclusion criteria included interval appendectomy, negative or incidental findings, significant concomitant illness or ICU admission, and open appendectomy in order to achieve a more homogenous cohort of patients. Data were obtained via retrospective review of the medical record. Data collected include demographic information, details of each child's hospital course including the presence of any initial complications defined as infectious or line complications prior to initial hospital discharge, operative complications, length, type, and route of inpatient and outpatient antibiotics, and need for emergency department (ED) or hospital readmission. Adverse outcomes included ED and hospital readmission rates, and development of postoperative complications. Outcomes were compared between those children who were discharged on IV antibiotics and those discharged on PO antibiotics. All appendectomies were performed by fellowship trained pediatric surgeons at a single tertiary care pediatric hospital. During the study period, eight different surgeons performed a relatively equal proportion of the operations.

Based on data published by St Peter and Colleagues in 2008, our institution utilizes a once daily regimen of IV ceftriaxone and metronidazole

for children with appendicitis [2]. This regimen is continued during a child's inpatient stay for children with complicated appendicitis based on the operating surgeon's preference. Upon discharge, the decision to continue antibiotic therapy, the route of antibiotic administration, the specific antibiotic administered, and the length of therapy is left to the discretion of the attending surgeon. There is no standard definition of perforated or complicated appendicitis at our institution. The decision to continue antibiotics is based on the attending surgeon's opinion of the appearance of the appendix and the amount of intraabdominal contamination found in the operating room.

1.1. Statistical analysis

Descriptive statistics were used to summarize demographic and baseline clinical characteristics. Mean and standard deviation are presented for continuous data. Student's t-test was used to compare means between groups. Chi-Square test or Fisher's exact test was performed to compare the difference in proportion between the two groups for binary or categorical data. Baseline differences that were detected were then included in multiple regression models as covariates. Outcomes were modeled using multiple logistic regression. All models were adjusted for initial complication, length of initial hospital stay, and number of days of home antibiotic therapy. Odds ratio with its 95% confidence intervals was reported. All statistical analysis was performed with SAS V9.3.

2. Results

During our study period, 325 children were discharged with antibiotics following appendectomy for acute appendicitis ($n = 291$ PO group; $n = 34$ IV group). Demographic data are presented in Table 1. The two groups did not differ in terms of the percentage of children who were male (58% oral vs. 56% IV; $p = 0.8$) or the mean age (9.7

Table 2
Univariate analysis demonstrating rate of complications among children with complicated appendicitis who receive PO or intravenous antibiotic therapy following discharge.

	Total	PO n = 291	IV n = 34	P value
Inpatient Readmission within 30 days, n (%)	16 (5%)	14 (4.8%)	2 (5.9%)	0.78
Number of Inpatient Readmissions, n(%)				0.80
0	309 (95.1%)	277 (95.2%)	32 (94.1%)	
1	14 (4.3%)	12 (4.1%)	2 (5.9%)	
2	2 (0.6%)	2 (0.7%)	0 (0%)	
ED Readmission within 30 days, n(%)	34 (10.5%)	30 (10.3%)	4 (11.2%)	0.77
Number of ED Readmissions, n(%)				0.75
0	291 (89.5%)	261 (89.7%)	30 (88.2%)	
1	28 (8.6%)	24 (8.3%)	4 (11.8%)	
2	4 (1.2%)	4 (1.4%)	0 (0%)	
3	1 (0.3%)	1 (0.3%)	0 (0%)	
9	1 (0.3%)	1 (0.3%)	0 (0%)	
Related Complications, n(%)	33 (10.2%)	28 (9.6%)	5 (14.7%)	0.35
Presence of an abscess post-discharge, n(%)	12 (3.7%)	11 (3.8%)	1 (2.9%)	1.00

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