

Urgent Versus Emergent Surgical Workflow For Acute Appendicitis in Children

Maxwell A. McMahon, BS; Katherine Ott, MD; Jonathan Vacek, MD, MS; Andrew Hu, MBBS; Chris DeBoer, MD; Samuel Linton, MD; Megan E. Bouchard, MD; Yue-Yung Hu, MD, MPH; Mehul V. Raval, MD, MS; and Seth D. Goldstein, MD, MPhil

Background

Appendectomy for acute appendicitis is the most common intra-abdominal operation in children.¹ However, there is no evidence-based consensus regarding timing for appendectomy following initial presentation despite extensive research aiming to characterize the effects of in-hospital delays on patient morbidity and mortality.^{2,3,4,5} Similarly, publications detailing the impact of increased preoperative delay on measures of efficiency of healthcare delivery, including patient cost and hospital length of stay, have failed to report congruent findings.^{6,7} In the absence of guidelines detailing the urgency of surgical intervention following diagnosis, the practice of delaying appendectomy has become more common.⁸ The potential benefits of increased urgency of appendectomy following the diagnosis of acute appendicitis must be balanced against potential costs to healthcare system burden and surgeon wellness.

Research Objectives

Through retrospective analysis of an institutional initiative to expedite all appendectomies during a trial period, we aimed to characterize the effects of emergent appendectomy for acute appendicitis on patient safety and healthcare system efficiency when compared to standard workflow. Primary outcomes studies were perforation rate, 30-day readmission, time in emergency department (ED), total preoperative time, and hospital length of stay.

Methods

Medical records were reviewed from pediatric patients who underwent an appendectomy at Lurie Children’s Hospital from August 2019 to January 2020, during which all appendectomies for acute appendicitis were performed emergently, defined as within 2 hours of diagnosis (expedited workflow). Outcomes were compared to data from appendectomies at Lurie Children’s Hospital from August 2018 to January 2019 (standard workflow).

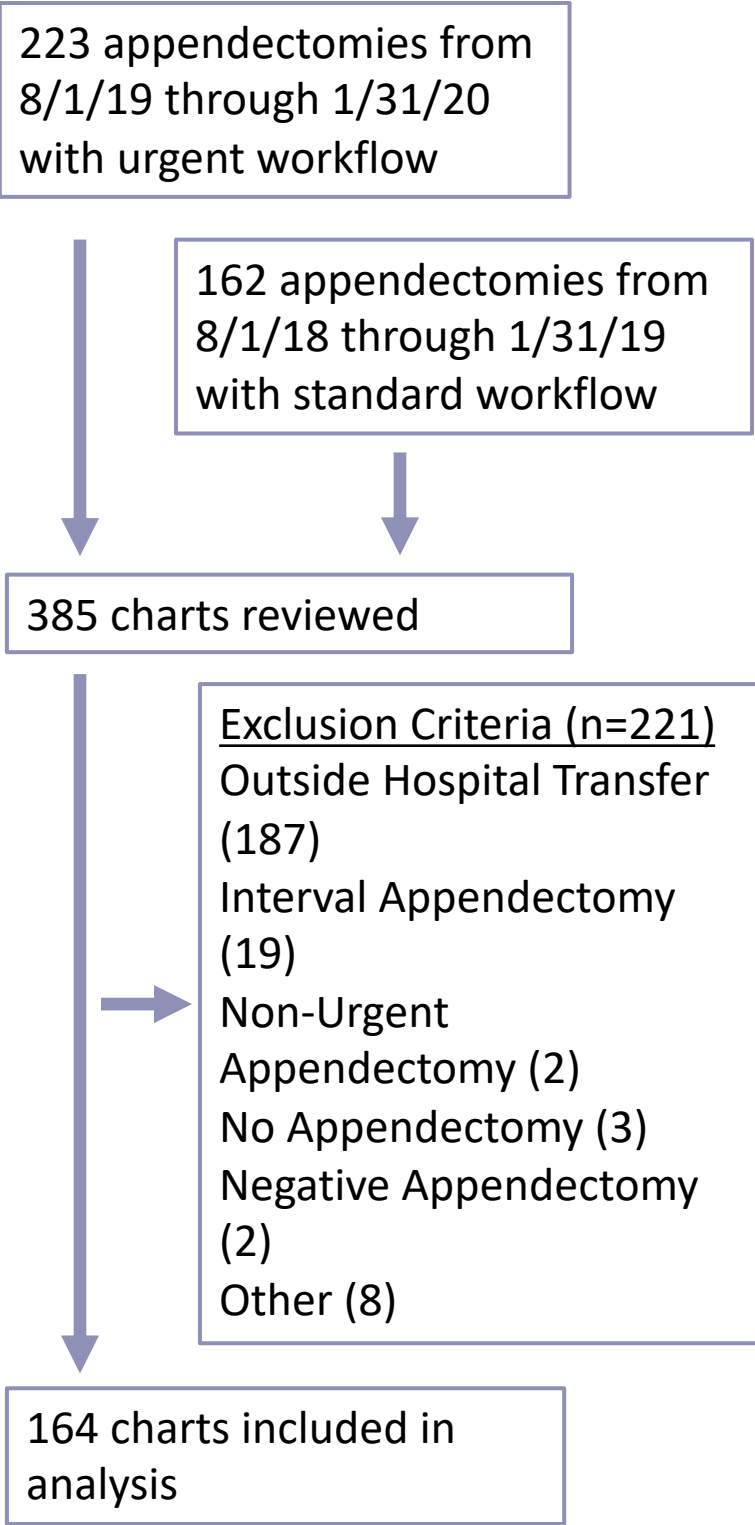


Figure 1. Workflow Data

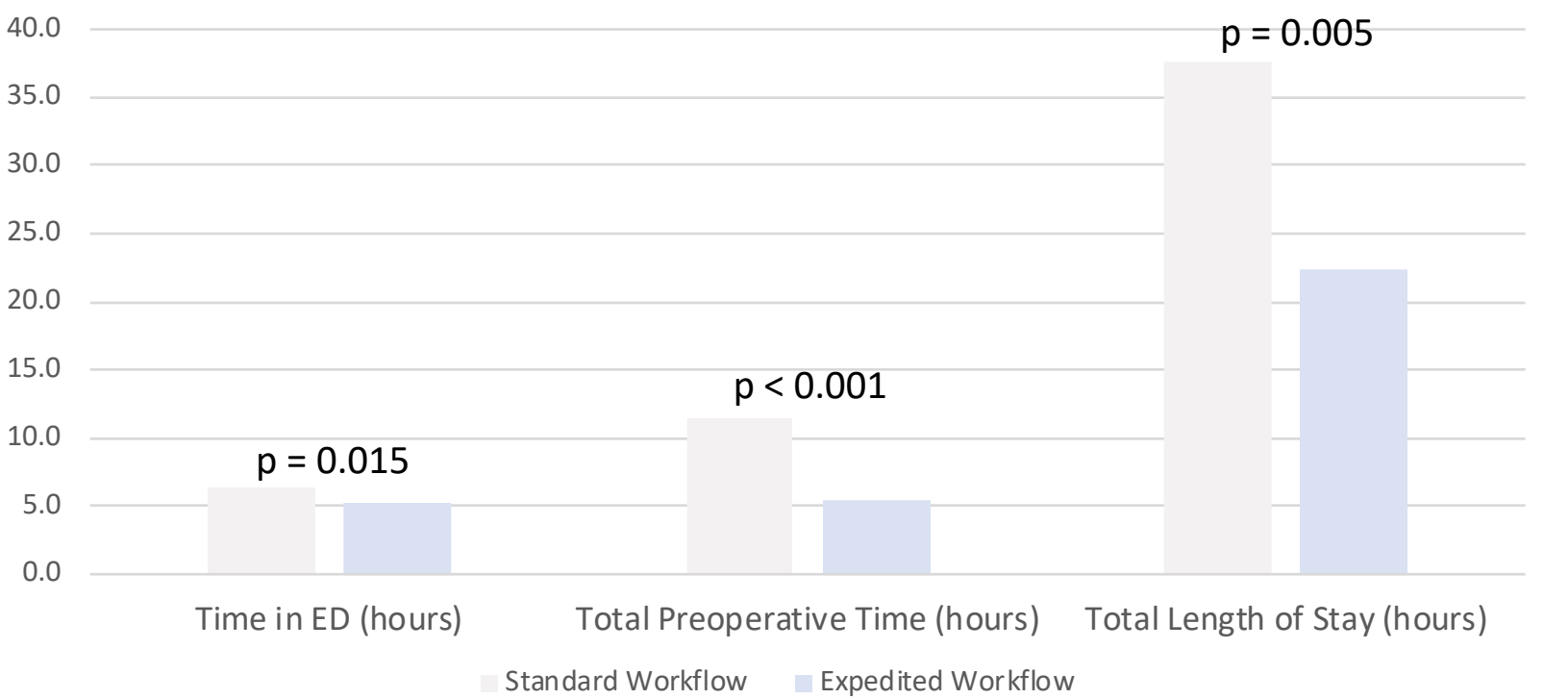


Table 1. Patient Characteristics and Outcomes Grouped by Intervention

Table 1: Patient characteristics and outcomes grouped by intervention time period (n=164)					
Characteristics/Outcomes	Standard Workflow n = 71 (43.3%)		Expedited Workflow n = 93 (56.7%)		p-value
	Patients (n)	%	Patients (n)	%	
Sex					
Male	42	59.2%	67	72.0%	0.083
Female	29	40.8%	26	28.0%	
Age					
<6 years	7	9.9%	12	12.9%	0.234
6-12 years	51	71.8%	55	59.1%	
13-18 years	13	18.3%	26	28.0%	
Ethnicity/Race					
Non-Hispanic White	18	25.4%	23	24.7%	0.258
Non-Hispanic Black	3	4.2%	4	4.3%	
Hispanic	45	63.4%	65	69.9%	
Other/Unknown	5	7.0%	1	1.1%	
Insurance					
Public	31	43.7%	45	48.4%	0.812
Private	37	52.1%	45	48.4%	
Other	3	4.2%	3	3.2%	
Hour of Presentation					
Business Hours (07:00-18:00)	49	69.0%	62	66.7%	0.750
On-call Hours (19:00-06:00)	22	31.0%	31	33.3%	
Perforation					
Not Perforated	50	70.4%	68	73.1%	0.703
Perforated	21	29.6%	25	26.9%	
30-Day Readmission					
No	68	95.8%	89	95.7%	0.981
Yes	3	4.2%	4	4.3%	
30-Day Complication					
No	61	85.9%	86	92.5%	0.256
Yes	10	14.1%	7	7.5%	
Characteristics/Outcomes		Mean	Mean		p-value
Symptom Duration (days)		1.8	1.7		0.56

Results

164 patients underwent an appendectomy during the trial periods, with 93 (56.7%) presenting in the expedited workflow period. In aggregate, there were no significant differences in baseline demographics, symptom duration, presentation time, perforation rates, 30-day readmissions, or reintervention rates between the two groups. The expedited workflow cohort was associated with shorter in-hospital time to OR (p<0.01) and hospital length of stay (p<0.010). In multivariate regression, complicated disease was associated with prehospital duration of symptoms, without significant effect from in-hospital time to OR.

Conclusions

We found that urgent surgical intervention for appendicitis had no effect on disease severity, patient morbidity, or other clinical outcomes. Notably, the overall hospital length of stay was shorter in the expedited cohort, however this must be interpreted in the context of quality improvement initiatives which were implemented in the intervening time between the standard and expedited trial periods. We conclude that outcomes associated with appendectomy are best predicted by prehospital factors, such as duration of symptoms, rather than in-hospital delays in surgical management.

Bibliography

- Guthery SL, Hutchings C, Michael Dean J, Hoff C. National estimates of hospital utilization by children with gastrointestinal disorders: analysis of the 1997 kids’ inpatient database. J Pediatr. 2004 May;144(5):589–94.
- Serres SK, Cameron DB, Glass CC, et al. Time to appendectomy and risk of complicated appendicitis and adverse outcomes in children. JAMA Pediatr. 2017 Aug 1;171(8):740-746.
- Boomer LA, Cooper JN, Anandalwar S, et al. Delaying appendectomy does not lead to higher rates of surgical site infections. Ann Surg. 2016;264(1):164-168.
- Meltzer JA, Kunkov S, Chao JH, et al. Association of delay in appendectomy with perforation in children with appendicitis. Pediatr Emerg Care. 2019;35(1):45-49.
- Bonadio W, Brazg J, Telt N, et al. Impact of in-hospital timing to appendectomy on perforation rates in children with appendicitis. J Emerg Med. 2015;49(5):597-604.
- Serres SK, Graham DA, Glass CC, Cameron DB, Anandalwar SP, Rangel SJ. Influence of time to appendectomy and operative duration on hospital cost in children with uncomplicated appendicitis. J Am Coll Surg. 2018 Jun;226(6):1014-1021.
- Taylor M, Emil S, Nguyen N, Ndiforchu F. Emergent vs urgent appendectomy in children: A study of outcomes. J Pediatr Surg. 2005;40(12):1912-1915.
- Muehlstedt SG, Pham TQ, Schmeling DJ. The management of pediatric appendicitis: A survey of North American pediatric surgeons. J Pediatr Surg. 2004;39(6):875-879.