



Non-operative Management for Acute Appendicitis During the COVID-19 Pandemic Does Not Increase the Rate of Complications

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Introduction

The COVID-19 pandemic has placed unprecedented stress on the healthcare system [1]. In response to government mandates and society recommendations, even emergency surgical procedures such as appendectomies have been curtailed, with non-surgical management used whenever possible [2, 3]. The goal of our study was to determine whether changes in acute appendicitis management have altered the frequency of complications in these patients.

Methods

IRB approval was obtained for this retrospective cohort study performed at an urban tertiary care medical center during the COVID-19 pandemic which in our area extended from March 15 through May 31, 2020. The equivalent 77-day

period from 2019 was used for comparison. The imaging database was queried for all reports with the word “appendicitis.” Imaging, operative notes, and pathology reports were used to classify cases as perforated or non-perforated appendicitis [4]. The EMR was reviewed for each case to extract the duration of symptoms prior to presentation, management, length of hospital stay (LOS), and complications within 45 days of presentation. Complications were divided into minor (Clavien-Dindo I and II) and major (Clavien-Dindo > II). Fisher exact tests were used to compare perforation rate, sex, baseline comorbidities, and non-operative treatment between years. Two sample *t* tests were used to compare age. Linear regression models were used to compare the duration of symptoms and LOS with perforation as a covariate. A Mantel-Haenszel test was used to compare complications conditional on perforation. Statistical analyses were performed using R-software.

This work has not been presented at a scientific meeting.

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Table 1 Comparison of clinical factors between the 2019 and 2020 cohorts

	2019	2020	<i>p</i> value
Perforation			
Acute appendicitis (<i>n</i>)	111	75	0.17
Perforated acute appendicitis (<i>n</i> , %)	23 (21%)	23 (31%)	
Days of symptoms prior to presentation (median ± IQR)			
Perforated	3 ± 2.5	3 ± 1.5	0.47
Non-perforated	1 ± 1	1 ± 1	
Treatment perforated (<i>n</i>, %)			
Non-operative	4 (17%)	3 (13%)	1.0
Other	19 (83%)	20 (87%)	
Treatment non-perforated (<i>n</i>, %)			
Non-operative	2 (2%)	21 (40%)	< 0.001
Other	86 (98%)	31 (60%)	
Hospital length of stay (median ± IQR)			
Perforated	4 ± 6.5	4 ± 5	0.73
Non-perforated	1 ± 1	1 ± 2	

Results

There were 75 cases of acute appendicitis in 2020 compared to 111 in 2019 (Supplemental Figure 1, Supplemental Table 1). There was a trend towards increased perforated cases in 2020 (23/75 [31%] in 2020 versus 23/111 [21%] in 2019) but was not statistically significant ($p = 0.17$, Table 1). While non-operative management for perforated cases was similar between 2020 and 2019 ($p = 1.0$), non-operative management was significantly more common for non-perforated appendicitis cases in 2020 ($p < 0.001$, Supplemental Table 2). Table 2 displays complications conditional on perforation and operative status. No difference was observed for complications between the 2 years ($p = 0.85$).

Table 2 Complications during the 2019 and 2020 periods stratified by type of appendicitis, treatment performed (“non-operative” indicating non-surgical treatment and “other” including appendectomy, elopement, and death), and complications

	Treatment	Complications	2019 (<i>n</i> = 111)	2020 (<i>n</i> = 75)
Perforated	Non-operative	Major	1	1
		Minor	0	0
		None	3	2
	Other	Major	3	3
		Minor	2	3
		None	14	14
Non-perforated	Non-operative	Major	0	0
		Minor	0	0
		None	2	21
	Other	Major	1	1
		Minor	3	0
		None	82	30

Of the 24 patients treated non-operatively in 2020, 7 (29%) underwent interval appendectomy at 84 ± 39 (mean ± SD) days after the initial presentation during 108–183 days of available follow-up. Three appendectomies were performed for persistent pain, two based on patient preference without new symptoms, one due to an asymptomatic appendicolith appearing on a follow-up exam, and one for definitive management of a previously perforated appendicitis.

Discussion

During the COVID-19 pandemic, the number of patients presenting with acute appendicitis markedly decreased compared to the prior year (32% drop). We speculate that this was due to mild cases of appendicitis resolving spontaneously as patients’ threshold for presenting to the hospital markedly increased during the pandemic. Spontaneous resolution of mild appendicitis has also been reported by Tankel et al. [5]. This suggests that we may be overtreating appendicitis, and efforts are needed to better distinguish patients who need surgical treatment versus those who do not.

This natural experiment corroborates other studies indicating that antibiotic treatment is an acceptable treatment alternative for non-perforated appendicitis, even during non-pandemic times [6]. Still, we also observed symptom-related interval appendectomies highlighting that such possibilities need to be discussed during informed consent and shared decision-making when deciding on the management of acute appendicitis.

Limitations of this study include single-center design and determination of complications based solely on re-presentation at our institution.

In conclusion, despite marked changes in the healthcare system during the COVID-19 pandemic and changes in appendicitis management, the complication rate remained the same compared to the pre-pandemic period despite a sharp spike in non-operative management.

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Data collection or management: Patel, Scheinfeld

Data analysis: Patel, Ye, In, Scheinfeld

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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