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# Acute Appendicitis During Coronavirus Disease 2019 (COVID-19): Changes in Clinical Presentation and CT Findings

SA-CME

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## Abstract

**Background:** Quarantine and stay-at-home orders are strategies that many countries used during the acute pandemic period of coronavirus disease 2019 (COVID-19) to prevent disease dissemination, health system overload, and mortality. However, there are concerns that patients did not seek necessary health care because of these mandates.

**Purpose:** To evaluate the differences in the clinical presentation of acute appendicitis and CT findings related to these cases between the COVID-19 acute pandemic period and nonpandemic period.

**Materials and Methods:** A retrospective observational study was performed to compare the acute pandemic period (March 23, 2020, to May 4, 2020) versus the same period the year before (March 23, 2019, to May 4, 2019). The proportion of appendicitis diagnosed by CT and level of severity of the disease were reviewed in each case. Univariate and bivariate analyses were performed to identify significant differences between the two groups.

**Results:** A total of 196 abdominal CT scans performed due to suspected acute appendicitis were evaluated: 55 from the acute pandemic period and 141 from the nonpandemic period. The proportion of acute appendicitis diagnosed by abdominal CT was higher in the acute pandemic period versus the nonpandemic period: 45.5% versus 29.8% ( $P = .038$ ). The severity of the diagnosed appendicitis was higher during the acute pandemic period: 92% versus 57.1% ( $P = .003$ ).

**Conclusion:** During the acute COVID-19 pandemic period, fewer patients presented with acute appendicitis to the emergency room, and those who did presented at a more severe stage of the disease.

**Key Words:** Abdominal CT, acute appendicitis, COVID-19, nonquarantine, quarantine, SARS-CoV-2

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## INTRODUCTION

From the moment of its discovery in December 2019, coronavirus disease 2019 (COVID-19) infections began a rapid exponential growth. On March 11, 2020, the World Health Organization declared the outbreak a global pandemic [1,2]. In April 2020, Lazzarini et al noted a

significant decrease in visits to the pediatric emergency department during the acute pandemic period in Italy, in a range between 73% and 88% when compared with the same period in previous years [3]. They also noted that a significant percentage of these visits required management in the intensive care unit, with higher rates of morbidity and mortality due to delayed care. Other large health systems have also reported significant decreases in imaging volume during the acute pandemic period [4,5].

Colombia declared a mandatory quarantine (stay-at-home order) from March 24, 2020, to May 31, 2020, as a preventive measure designed to stop the spread of

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COVID-19. The quarantine brought a significant decrease in the demand for specialized hospital outpatient health services. At our institution, we noted a decrease in the total number of procedures, and we also found patients arriving with acute pathologies in more advanced states of complication than normal. One of these is acute appendicitis, which is among the most common causes of acute abdominal pain. Appendicitis can have a rapid evolution, with perforation rates of 16% to 40%, and more frequent complications in younger age groups and in patients over 50 years of age [6]. Appendicular perforation is associated with increased morbidity and mortality compared with acute nonperforated appendicitis, with mortality rates of 5% in perforated appendicitis [6].

We hypothesized that during the acute COVID-19 pandemic period, presentation to the emergency department for suspected appendicitis decreased and patients were obtaining emergency services later and in more advanced stages of the disease. The purpose of this study is to determine the difference in the proportion and severity of suspected acute appendicitis as diagnosed by CT during the acute pandemic versus the nonpandemic period.

## METHODS

Because we intended to compare the acute pandemic period with the nonpandemic period, we matched the dates for the acute pandemic period with the same dates in 2019. Each period was composed of 42 days (March 23 to May 4, 2020, and March 23 to May 4, 2019).

We included all abdominal CT scans performed for suspected appendicitis in each period. All CTs were reviewed by a radiologist and evaluated for the presence of appendicitis, the anteroposterior diameter, and classification into one of five grades: 1 = probable appendicitis, 2 = appendicitis, 3 = appendicitis with peri-appendicitis, 4 = appendicitis with rupture, and 5 = complicated appendicitis [7]. We also obtained sociodemographic variables including age and gender.

Statistical analysis was performed using SPSS (released 2017; IBM SPSS Statistics for Windows, version 25.0, IBM Corp, Armonk, New York). Normality analyses were performed for quantitative variables. Univariate analysis results are presented with a mean and SD or percentage. Bivariate analysis with the  $\chi^2$  or the Fisher test for qualitative variables and the Student's *t* or Mann-Whitney *U* test for quantitative variables. Statistical significance was considered when  $P < .05$ .

## RESULTS

During the nonpandemic comparison period from 2019, 141 abdominal CT scans were performed versus 55 during

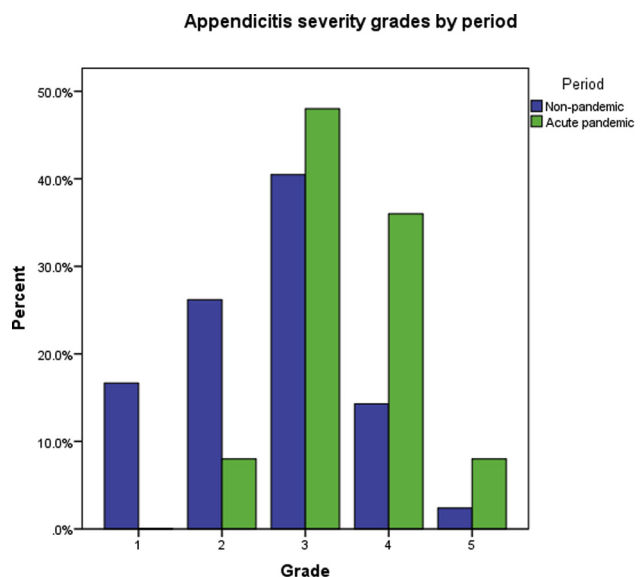
**Table 1.** Population characteristics

Characteristic	Nonpandemic (n = 135)	Acute Pandemic (n = 54)	<i>P</i> Value
Age, mean (SD)	38.21 (18.186)	36.56 (16.93)	.566
Gender, n (%)			
Men	38 (27.00)	21 (38.20)	.124
Women	103 (73.00)	34 (61.80)	
Appendicitis	42 (29.80)	25 (45.50)	.038

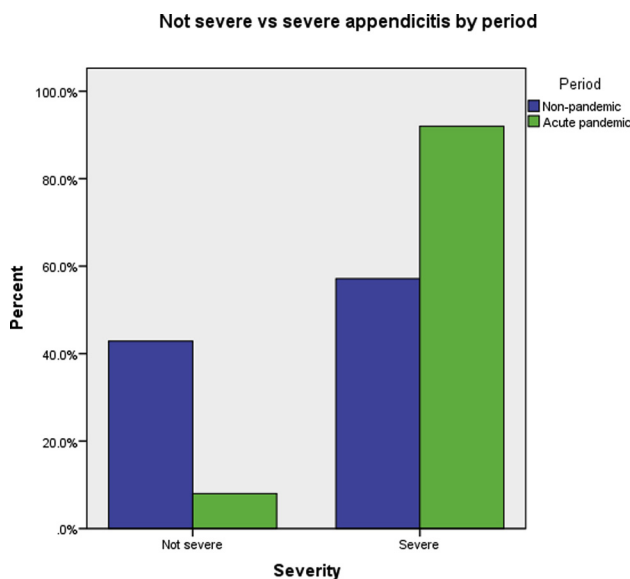
the acute pandemic period in 2020, representing a decrease of 61% for the total number of abdominal CT scans performed for appendicitis.

Table 1 describes the sociodemographic characteristics for the nonpandemic and the acute pandemic periods. The mean age of patients between the two groups were similar (34.36 [SD 16.298] years in the nonpandemic versus 36.56 [SD 16.93] years in the pandemic period). There were no statistically significant differences in sociodemographic characteristics between the two groups.

There was a higher proportion of appendicitis diagnosed by abdominal CT scans in the acute pandemic period versus nonpandemic comparison period ( $P = .038$ ; Table 1). The



**Fig 1.** Appendicitis severity grades by period. The y axis is the percentage of the total number of CTs by period, and the x axis is the grade of appendicitis. The acute pandemic period has more cases of appendicitis classified between grades 3 and 5, and in the nonpandemic period, the appendicitis cases are classified between grades 1 and 3.



**Fig 2.** Not severe versus severe appendicitis by period. The y axis is the percentage of the total number of CTs by period, and the x axis is the grade of appendicitis. A higher severity is shown on the acute pandemic period than in the nonpandemic period.

appendicular anteroposterior diameter was compared among the cases of appendicitis diagnosed by abdominal CT. During the nonpandemic comparison period, the mean diameter was 10.33 (SD 2.30) mm, and in the acute pandemic period, the mean diameter was 13.96 (SD 2.45) mm ( $P < .001$ ).

The severity score proportions for all diagnosed cases of appendicitis in each period are shown in Figure 1. During the nonpandemic comparison period, we found that most appendicitis cases were classified as grades 2 or 3. In contrast, in the acute pandemic period, most appendicitis cases were grades 3 or 4. When we dichotomize the scores into high and low severity, the difference between severe and nonsevere is more evident, as seen in Figure 2 ( $P = .003$ ).

## DISCUSSION

In our department, the effects of COVID-19 pandemic on a common emergent clinical scenario such as acute appendicitis are evident. Our analysis demonstrates that the volume of radiological examinations for acute appendicitis decreased overall and the proportion of severe cases increased during the acute pandemic period. The results of this study show a reduction of 61% in the total number of abdominal CT scans performed in patients with signs of appendicitis. However, those diagnosed with appendicitis by CT are presenting at later stages with greater disease severity. These

results are congruent with the initial hypothesis that people are postponing visiting the emergency room until their symptoms become severe during the acute pandemic period.

The principal limitation of this study is that we only evaluated data from one institution, and we cannot extrapolate these findings to other settings. Another limitation that we recognize is that in the nonpandemic period, our hospital normally serves not only the local population but also people from different areas of the city and the country. However, because of pandemic restrictions, many people cannot travel, so they may frequent hospitals closer to their places of residence instead.

In summary, during the acute pandemic period, fewer patients presented to the emergency room with suspected appendicitis, and those who did have appendicitis had more severe stage of disease at the time of presentation.

## TAKE-HOME POINTS

- During the acute COVID-19 pandemic period, the number of abdominal CT scans performed on patients suspected of having acute appendicitis decreased by 57%.
- A higher proportion of acute appendicitis diagnoses have been made during the acute pandemic period than in the nonquarantine period.
- Abdominal CT scans performed on patients with appendicitis during the acute pandemic period show a higher severity of disease when compared with cases in the nonpandemic comparison period.

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