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Impact of COVID-19 Outbreak on the Emergency Presentation of Acute Appendicitis

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Abstract

Background: The global crisis resulting from the coronavirus pandemic has imposed a large burden on health systems worldwide. Nonetheless, acute abdominal surgical emergencies are major causes for nontrauma-related hospital admissions and their incidences were expected to remain unchanged. Surprisingly, a significant decrease in volume and a higher proportion of complicated cases are being observed worldwide.

Methods: The present study assesses the local impact of the coronavirus pandemic on the emergency presentation of acute appendicitis in a Brazilian hospital. A retrospective analysis was conducted on patients undergoing emergency surgery for the clinically suspected diagnosis of acute appendicitis during the 2-month period of March and April 2020 and the same time interval in the previous year. Data on demographics, timing of symptom onset and hospital presentation, intraoperative details, postoperative complications, hospital length of stay, and histological examination of the specimen were retrieved from individual registries.

Results: The number of appendectomies during the pandemic was 36, which represents a 56% reduction compared to the 82 patients operated during the same period in 2019. The average time of symptom onset to hospital arrival was significantly higher in 2020 (40.6 vs. 28.2 hours, $P = .02$). The classification of appendicitis revealed a significant higher proportion of complicated cases than the previous year (33.3% vs. 15.2%, $P = .04$). The rate of postoperative complications and the average length of stay were not statistically different between the groups.

Conclusion: Further assessment of patients' concerns and systematic monitoring of emergency presentations are expected to help us understand and adequately address this issue.

Keywords

appendicitis, surgery department, hospital, emergency service, hospital, COVID-19

Introduction

In late December 2019, an outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection was first reported in Wuhan, China and rapidly spread to other countries worldwide.[1] The coronavirus disease (COVID-19), caused by the newly identified pathogen, was recognized as a pandemic by the World Health Organization (WHO) on March 11, 2020.[2] To the date, more than 18 900 million cases of COVID-19 have been confirmed, resulting in more than 700 000 fatalities.[3] As of June 20, Brazil surpassed 1 million confirmed cases and nearly 50 000 deaths,[4] becoming the country with the second-highest number of coronavirus infections worldwide, behind the United States.

The unprecedented global crisis resulting from the coronavirus pandemic has imposed a large burden on medical systems worldwide. Nonetheless, acute abdominal emergencies requiring surgery constitute one of the most common causes for nontrauma-related hospital admissions.[5] Considering their high prevalence and the negative impact of delays in diagnosis and treatment, the number of urgent procedures would be expected to remain unchanged, even during the pandemic.[6]

Surprisingly, a significant decrease in surgical emergencies and a higher proportion of complicated cases are

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being observed by several surgeons worldwide since the onset of the COVID-19 outbreak. We assessed the local impact of the pandemic on the emergency presentation of acute appendicitis in a Brazilian hospital.

Methods

This retrospective, observational study was conducted at Hospital Moinhos de Vento (in Portuguese, HMV)—Johns Hopkins Medicine International affiliated, a tertiary private nonprofit institution located in Porto Alegre, Rio Grande do Sul—the southernmost state in Brazil. All patients over 12 years of age undergoing emergency surgery for the clinically suspected diagnosis of acute appendicitis during the 2-month period of March and April 2020 and the same time interval in the previous year were included.

Data on demographics, timing of symptom onset and hospital presentation, surgical technique (laparotomy or laparoscopy), intraoperative details, postoperative complications, hospital length of stay, and histological examination of the specimen were retrieved from individual registries. Patients with a final diagnosis of normal appendix or noninfectious causes of acute appendicitis, such as appendiceal tumors, were reported as negative appendectomies. Participants managed nonoperatively were also noted, though excluded from final analysis.

The appendix pathology was classified according to the operative findings as: grade 0, normal looking appendix (endoappendicitis/periappendicitis); grade 1, hyperemia, edema, and fibrinous exudate without or little pericolic fluid; grade 2, segmental or base necrosis without or little pericolic fluid; grade 3, phlegmon or abscess without peritoneal free air; and grade 4, diffuse peritonitis, as proposed by Gomes et al[7]. Cases were further subclassified into uncomplicated (grades 0 and 1) or complicated appendicitis (grades 2, 3, and 4). Postoperative complications were categorized according to the Clavien-Dindo classification system.

Statistical analysis was carried out using IBM SPSS v26.0 software. Patients were divided into 2 groups based on the year of admission (2019 or 2020) for comparison. Pearson chi square or Fisher's exact test were applied to compare categorical values where appropriate. Continuous variables were compared using 2-tailed t-test or Mann-Whitney U test for parametric and nonparametric data, respectively. The significance threshold was set at a P value of $< .05$. Ethical approval for this study was obtained from the institutional ethics and research committee with a waiver of informed consent, under the registration number 4.185.771.

Results

The number of appendectomies during the pandemic was 36, which represents a 56% reduction compared to the 82 patients operated during the same period in 2019. Two patients were successfully managed conservatively with antibiotics in 2020 and therefore excluded from analysis. The mean age at surgery was 35 ± 16 years (range 12-83), and the majority were women (60.2%; n = 71).

The average time of symptom onset to arrival at the emergency department was significantly higher during the COVID-19 period (40.6 vs. 28.2 hours, $P = .02$). All but 1 procedure were completed laparoscopically, as an open appendectomy under regional anesthesia was indicated in the first confirmed infected patient, in accordance with the first international recommendations.

The classification of appendicitis revealed a significantly higher proportion of complicated cases during the pandemic than the previous year (33.3% vs. 15.2%, $P = .04$), notably due to the increased ratio of diffuse peritonitis (15.2% vs. 3.8%, $P = .05$). In 3 cases of each period, the information provided in the record was insufficient to grade the disease.

The overall rate of postoperative complications was 13.6%, mainly due to ileus, intra-abdominal abscesses, or surgical site occurrences. The average length of stay was 2.3 ± 2.4 days (range 1-15) and did not show statistically significant differences between the groups. The negative appendectomy rate was similar between both groups. No reoperations or deaths were reported. Patient's clinical characteristics and outcomes are reported in Table 1.

Discussion

The presented data indicate that emergency surgery for suspected appendicitis in our institution was reduced to half the activity during the first months of the pandemic. This reflects the pronounced overall decrease of gastrointestinal complaints in emergency consultations and admissions at our institution, as reported by Leite et al.[8] Our findings are consistent with those previously reported in the literature, suggesting the impact of COVID-19 on surgical practice represents a widespread phenomenon. Several authors, particularly in heavily affected countries, have also experienced a 40-86% decrease in nontraumatic surgical emergencies following the coronavirus outbreak.[9-13]

Acute appendicitis represents the most common abdominal surgical emergency worldwide, and prehospital delay is an independent predictor of complicated disease, which may result in unnecessary morbidity and increased mortality.[14] We have documented a significant increase in the average time of symptom onset to hospital arrival during the pandemic period. This was probably a major factor underlying the higher rates of complicated appendicitis and diffuse peritonitis observed in this group. An unusual rate of late presentations[10,15-16] and complicated disease[12,16-17] has also been recently reported in other studies.

Table 1. Baseline Characteristics and Outcomes of Patients Undergoing Appendectomy. *ns = Statistically Non-Nonsignificant.

	2019	2020	Total	*P* value
Month (%)				
March	39 (47.6)	19 (52.8)	58 (49.2)	ns*
April	43 (52.4)	17 (47.2)	60 (50.8)	
Total	82 (69.5)	36 (30.5)	118 (100)	
Age (years)	34.3 ± 15.8 (12-79)	38.2 ± 18.1 (12-83)	35.5 ± 16.6 (12-83)	ns*
Gender (%)				ns*
Female	51 (62.2)	20 (55.6)	71 (60.2)	
Male	31 (37.8)	16 (44.4)	47 (39.8)	
Onset-to-arrival (hours)	28.2 ± 23.2 (1-120)	40.6 ± 35.5 (6-168)	32 ± 28 (1-168)	**.02**
Grading *(%)*				**.05**
0	13 (16.5)	2 (6.1)	15 (13.4)	
1	54 (68.4)	20 (60.6)	74 (66.1)	
2	3 (3.8)	2 (6.1)	5 (4.5)	
3	6 (7.6)	4 (12.1)	10 (8.9)	
4	3 (3.8)	5 (15.2)	8 (7.1)	
Total	79 (100)	33 (100)	122 (100)	
Classification (%)				**.04**
Uncomplicated	67 (84.8)	22 (66.7)	89 (79)	
Complicated	12 (15.2)	11 (33.3)	23 (20.5)	
Total	79 (100)	33 (100)	122 (100)	
Length of stay (days)	2.4 ± 2.6 (1-15)	2.2 ± 2 (1-8)	2.3 ± 2.4 (1-15)	ns*
Postoperative complications (%)				ns*
Ileus	4 (4.9)	2 (5.5)	6 (5)	
Intra-abdominal abscess	3 (3.6)	0	3 (2.5)	
Wound infection	1 (1.2)	2 (5.5)	3 (2.5)	
Sepsis	2 (2.4)	0	2 (1.7)	
Wound hematoma	1 (1.2)	0	1 (.8)	
Total	11 (13.4)	4 (11.1)	15 (12.7)	
Clavien-Dindo (%)				ns*
I	5 (6.1)	3 (8.3)	8 (6.8)	
II	3 (3.7)	1 (2.8)	4 (3.4)	
III-A	3 (3.7)	1 (2.8)	4 (3.4)	
Negative appendectomy (%)				ns*
Mesenteric adenitis	0	1 (2.8)	1 (.8)	
Ruptured ovarian cyst	1 (1.2)	0	1 (.8)	
Intussusception	1 (1.2)	0	1 (.8)	
Appendiceal primary tumour	1 (1.2)	0	1 (.8)	
Total	3 (3.6)	1 (2.7)	4 (3.3)	

Some authors noted that these advanced cases were associated with worse postoperative outcomes.[12,15-16] However, our complication rates and reoperations were similar in both groups. We believe that the short follow-up period for some patients included in the study may have limited the assessment of complications after hospital discharge. The mean length of stay also did not show statistically significant differences between periods. This reflects the strong consideration that has been given to early discharge whenever possible during the pandemic,[12] in order to mitigate the spread of SARS-CoV-2 in surgical wards and increase the availability of beds, material, and human resources.

It seems likely that patients' apprehension about contracting the virus at public places and emergency departments has been a major reason for the reduced urgent surgical activity and the unusual proportion of delayed presentations. This was also observed in other potentially life-threatening conditions, such as acute coronary syndrome and stroke, and indicates a generalized problem for emergency services.[18] Rigorous social distancing policies were implemented by governments and health entities worldwide, encouraging people to stay at home and avoid visiting local medical facilities. Likewise, mass media coverage depicted hospitals as overcrowded and high-risk environments for COVID-19

exposure, thus contributing to the reluctance to seek medical care.[19] This qualitative analysis on people's health care seeking behavior, however, was not included in the study design.

Another contributing factor to the reduced number of appendectomies may have been the increasing role of the nonoperative management of abdominal infections.[6] Although surgery is still considered the gold standard for the treatment of acute appendicitis, recent guidelines have proposed antibiotic therapy alone as a first-line approach to uncomplicated cases during the pandemic.[14,20-21] This strategy is recommended as a means of avoiding hospitalization, ultimately preserving inpatient resources and minimizing the risk of COVID-19 transmission during droplet and aerosol-generating procedures.[6] Indeed, in our series, 2 patients were successfully managed conservatively in the pandemic period. This remarks a change in normal surgical practice, albeit not very expressive.

Recent studies suggest that health care system overload has played a key role in the decrease of surgical admissions,[6,22] since the demand for equipment, hospital space, and personnel to provide surge capacity has strained surgical resources. Surgery departments have been dramatically impacted by the reorganization of operating theatres, postoperative recovery postoperative recovery rooms, and anesthesia carts into temporary respiratory support units to manage COVID-19 patients.[23] Also, staff shortages due to self-quarantine, contact exposure, coronavirus infection, or redeployment to critical care services have demanded triage even for urgent operations.[6]

This premise, however, does not seem to explain our findings, as our hospital did not impose any restrictions on emergency surgery services during the outbreak. Otherwise, HMV has started preparing for a potential surge in the number of cases even before receiving alerts from the Brazilian national health care system.[24] Of note, by March 11th, when the first case was confirmed in the city of Porto Alegre, the hospital had already implemented specific measures to ensure the continuity of essential services by augmenting in-hospital capacity, rearranging staff workforce, and establishing both risk mitigation strategies and effective use of resources.[24]

Our institution provides care for privately insured patients, who represent 43% of the city's population and 23.2% of the state of Rio Grande do Sul.[25] We highlight the impact of the economic crisis on the access to hospital care, as many have lost employed-based or private medical insurances and are now dependent on public health services. These patients could be seeking medical attention in public hospitals in the region and account for a diversion of our surgical volume. Nevertheless, this needs to be addressed by further local studies.

Our results documented the collateral effect of the current COVID-19 pandemic on the emergency surgical activity. Limitations of this study are its retrospective observational nature and those inherent to using medical records as data sources. Being a single-center evaluation, we cannot extrapolate our findings to other settings, and neither could we address community-based pattern changes in the access to hospital care. However, our findings hold important public health implications. The medical community, health care institutions, governments, and media should communicate the measures undertaken to ensure patient safety and the capacity to provide diligent care for other time-sensitive, non-COVID-19-related conditions. Further assessment of patients' concerns and systematic monitoring of emergency presentations are warranted to help us understand and adequately address this issue.

Declaration of Conflicting Interests

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Ethics Approval and Consent to Participate

The study protocol is in accordance with the ethical standards of the institution at which the project was conducted and ethical approval was obtained from the institutional ethics and research committee, with a waiver of informed consent, under the registration number 4.185.771.

Availability of Data and Material

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

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