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Case Report
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Emergency Appendectomy and COVID-19 Pandemic: Different Outcomes?

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Abstract

Introduction: Acute appendicitis is a common cause of emergency room visit requiring surgery. The absence or delay in treatment is associated with severe complications and increase of morbidity and mortality. Due to the COVID-19 pandemic, there was a decrease in the number of visits to the emergency department due to surgical pathology. The authors intend to infer whether patients with appendicitis presented in more advanced stages of the disease and whether this may have influenced the outcomes.

Methods: A retrospective observational study was done at a tertiary center, in an urgent surgery context, with the purpose of evaluate and compare the patients of two groups, the first in a year period without COVID-19 pandemic and the second during a year the COVID-19 pandemic. A total of 387 patients diagnosed with acute appendicitis were evaluated (222 in the first group and 165 in the second group).

Results: The authors found a statistically significant difference between the groups regarding the presentation of the disease with complicated disease. In the presence of complicated disease with abscess or peritonitis, the approach route did not show statistical differences between groups.

Conclusion: The impact of the COVID-19 pandemic was manifested in a decrease in the total number of patients diagnosed with acute appendicitis, an increase in severity of the initial presentation and cases of complicated acute appendicitis. Laparoscopic surgery was performed at a higher rate during the COVID-19 pandemic, but the rate of midline incisions increased in patients submitted to open surgery.

There was no significant increase in postoperative complications, morbidity and mortality in the period of COVID-19 pandemic.

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Introduction

Appendicitis is a common cause of abdominal pain, motivating the use of the emergency department and requiring surgery (7% to 10%) [1,2]. In developed countries, this surgical disease occurs at a rate of 5.7 to 50 patients per 100,000 inhabitants per year [2].

In most cases, the diagnosis of acute appendicitis depends heavily on the clinical presentation. Patients typically complain of anorexia followed by epigastric or periumbilical abdominal pain, that migrate to the right lower quadrant [1,3].

Usually, without treatment, the appendiceal inflammation will progress to necrosis and perforation, with several complications. The time course of this progression varies among patients [3]. In some studies, 20% of cases of perforated appendicitis were presented within 24 h of the onset of symptoms; however, in other studies there are cases of patients who had symptoms for only 11 h [3].

The perforation rate is higher at extremes of age and in immunocompromised patients [2]. Appendiceal perforation is associated with increased morbidity and mortality compared with non-perforated acute appendicitis [2].

Typically, in laboratory studies, the White Blood Cell count (WBC) is normal or slightly elevated in non-perforated appendicitis but may be quite elevated in the presence of perforation [3]. The presence of leukopenia can also be a sign of infection, which can be associated with more severe degrees of disease. The C-Reactive Protein (CRP) can be elevated or not [1].

The imagiological diagnosis can be done with Ultrasound (US), Computed Tomography (CT)

or Magnetic Resonance Imaging (MRI) [2]. US is an exam with good sensitivity and specificity, when performed by an experienced radiologist and in individuals with a favorable morphotype. CT has better sensitivity and specificity than US, especially in cases of suspected complicated appendicitis. However, it is associated with the presence of radiation, a disadvantage in the case of pregnant women. In these cases, when available, it is possible to resort to the use of MRI [1,2].

The treatment of choice is urgent appendectomy, with good results with laparoscopic appendectomy [2].

A delay on surgery of up to 24 h in patients with uncomplicated acute appendicitis does not appear to be a significant risk factor and is not associated with increased mortality. Appendectomies performed 24 h after admission are related to increased postoperative morbidity, with complications such as perforation, peritonitis and septic shock [1,2].

SARS-CoV-2 virus (COVID-19) was first reported in December 2019 in Wuhan, China, and spread throughout the world. On March 2nd, 2020, the first two cases of COVID-19 were confirmed in Portuguese territory. With the declaration of the disease as a pandemic, several confinement measures were implemented throughout the country [4]. These measures leaded to a decrease in the number of visits of the Emergency Department in 2020.

In April, in particular, there was a 23% decrease in urgent surgeries performed compared to the same month in 2019. The number of hospitalizations in the Portuguese health public system dropped around 15%, 38% and 32% in March, April and May, respectively, compared to the same months in 2019. Finally, the number of episodes in the emergency department was 37%, 52% and 45% lower, in the months of March, April and May, respectively, compared to the same periods in 2019 [5].

The SARS-CoV-2 virus is transmitted through aerosolized particles, and based on this knowledge, the aerosol generating procedures are associated with an increased risk of infection [6].

In laparoscopic surgery, the pneumoperitoneum is an essential step, but increase the risk of aerosol exposure to the operating team. Although the risk is also present during open surgery, it was initially believed that laparoscopic surgery was associated with a greater risk [6,7].

Today, we know that there is no scientific evidence of transmission of SARS-CoV-2 virus by laparoscopic surgery. Laparoscopy, if strongly indicated, can be used with precautions due to its benefits for the patient compared to open surgery [6].

Materials and Methods

The authors present a retrospective observational study where the main purpose is to evaluate the outcomes of patients submitted to an appendectomy in the Emergency Department of a tertiary hospital, and to compare the prevalence and severity of the cases in the "non-COVID-19" Year with the "COVID-19" Year (from March 2nd, 2019 to March 1st, 2020, and from March 2nd, 2020 to March 1st, 2021, respectively).

The secondary purpose is to compare the types of treatment, surgical approaches, postoperative complications, length of stay, morbidity and mortality of this patients.

An analysis was performed of the population's demographics, time of evolution, severity, treatment options, postoperative complications, morbidity and mortality comparing 2 groups (1st group – 12 months prior to the pandemic and 2nd group – 12 months during the pandemic).

All adults' patients with a diagnosis of acute appendicitis, between the period mentioned above, were included. Pediatric patients (<18 years) were excluded.

Two groups were established: The 1st group being of the "no COVID" year (2nd of march 2019 to 1st of march 2020) and the 2nd group being of the "COVID-19" year (2nd of march 2020 to 1st of march 2021).

The authors define "uncomplicated appendicitis" to phlegmonous appendicitis and "acute complicated appendicitis" to gangrenous, perforated appendicitis, or with appendicular abscess or peritonitis.

The patient's previous comorbidities were not taken into account in terms of postoperative outcome, as the authors assume that the therapeutic options used were in accordance with them.

We used de Chi-square test and was defined as a statistically significant value a p-value <0.05.

Results

A total of 387 patients with clinical or imaging diagnosis of acute appendicitis were evaluated. The 1st group had a total of 222 patients (110 males and 112 women) and the 2nd group had 165 patients (80 males and 85 women). The mean age was 40 years and the median was 33 years in the first group and 36 years in the second group, with the ages varying between 18 and 93 years in the first group and between 18 to 83 years in the second group. In the "COVID-19" year there were three cases of concomitant infection with SARS-CoV-2 virus.

In the 1st group, a total of 151 cases of uncomplicated appendicitis and 71 cases of complicated appendicitis were identified, and in the 2nd group, 82 cases of uncomplicated appendicitis and 83 cases of complicated appendicitis were identified. There was a statistically significant difference between the groups (p=0.0003) (Table 1).

In regard to the complicated appendicitis cases in the "no COVID" year, out of the 71 cases of complicated appendicitis, 16 had appendicular abscess and 19 had peritonitis, and in the "COVID-19" year, out of the 83 cases, 18 had appendicular abscess and 25 had peritonitis (Table 2).

Regarding to the approach method, in the 1st group, 133 patients were submitted to an open surgery and 89 to a laparoscopic surgery. In the 2nd group, 93 patients were submitted to an open surgery and 62 to laparoscopic surgery. There were 10 conversion cases from

Table 1: Distribution of cases upon presentation of appendicitis.

	"no-COVID"	"COVID-19"
Uncomplicated appendicitis	151 (68.02%)	82 (49.70%)
Complicated appendicitis	71 (31.98%)	83 (50.30%)
Total	222	165

Table 2: Distribution of cases with complicated appendicitis about the presence of appendicular abscess or peritonitis.

	"no-COVID"	"COVID-19"	p-value (<0.05)
Appendicular abscess	17 (23.94%)	18 (21.69%)	*0.28*
Peritonitis	19 (26.76%)	25 (30.12%)	*0.052*
Total	71	83	

Table 3: Distribution of cases by approach.

	"no-COVID"	"COVID-19"	p-value (<0.05)
Laparoscopic surgery	89 (40.09%)	62 (37.58%)	*0.674*
Open surgery	133 (59.91%)	103 (62.42%)	
Conversion	10	0	*0.007*
Median laparotomy	6	13	*0.03*

laparoscopy to open procedures in the 1st group, while no cases were documented in the 2nd group. Concerning the patients submitted to an open approach, 6 cases underwent a median laparotomy in the 1st group and 13 in the 2nd group.

The approach (laparoscopic *vs*. open surgery) did not represent a statistically significant difference between the two groups (p=0.674). Also, the presence of complications such as abscess formation (p=0.28) or peritonitis (p=0.052) did not represent a statistically significant difference between the two groups. However, the conversion rate to open surgery was statistically lower in the 2nd group (p=0.0073), and the initial option for midline laparotomy was statistically lower in the 1st group (p=0.03) (Table 3).

In the group of the "no COVID" year, the authors identify a total of 7 cases of complications, particularly: One case of seroma, one wound infection, one surgical wound dehiscence, one case of abscess formation at the surgical site, one appendicular stump fistula and one case of intestinal obstruction. Based on the Clavien-Dindo surgical complication classification, patients were evaluated as I (3 cases), II (3 cases), and IIIb (1 case). Two of these patients required readmission at the hospital. The hospital readmissions causes were due to intestinal obstruction and appendicular stump fistula and both were managed conservatively. The cause for intestinal obstruction was CT-documented bands.

In the group of the "COVID-19" year, were identified a total of 12 cases of complications, including one case of seroma, one case of laparoscopy port bleeding, one wound infection, four cases of abscess formation (one at the surgical site, another in pelvic region and two in the abdomen cavity), two cases of appendicular stump fistula and one case of ileus. Based on the Clavien-Dindo surgical complication classification, patients were evaluated as I (3 cases), II (2 cases), IIIa (2 cases) and IIIb (1 case). One of these patients required readmission to the hospital, due to intra-abdominal collections, and was treated with percutaneous drainage.

We verified one case of reoperation in the first group and two cases in the second group.

There were no documented cases of postoperative mortality (determined as 30 days after surgery).

There were no statistically significant differences between both groups regarding postoperative complications, need for reoperation, readmission or mortality. The three cases with concomitant COVID-19 infection, showed no statistically significant differences comparing to the "non-COVID" patients.

The length of hospital stay was evaluated, and a variation between 0 (<24 h) and 46 days was verified the 1st group, with an average length of stay of 3.72 days and a median of 2 days. In regard to the 2nd group, the length of stay ranged from 0 (<24 h) to 36 days, with an average length of stay of 3.78 days and a median of 2 days. No statistically significant differences were identified between the groups in terms of length of stay.

Discussion

In this analysis, it was possible to verify a decrease in the total number of cases of acute appendicitis in the "COVID-19" year. The authors believe that this finding may be related to the overall decrease in the number of patients recurring to the emergency department during the COVID-19 pandemic period. It may also be due to the fact that this hospital was considered a COVID-19 reference hospital and thus increasing the concern on patients of possible virus transmission. There are probably two more explanations to this fact: The first one is related to the fact that in some cases, acute appendicitis may have a spontaneous resolution, the second explanation is associated with possible diagnostic errors in the emergency department, (i.e., when empirically antibiotics, anti-inflammatory or analgesics are prescribed and thus may mask other symptoms or diagnoses).

Another aspect observed in this study was the increase in number of more severe cases of acute appendicitis (gangrenous and perforated acute appendicitis) during COVID-19 pandemic. However, there are no statistically significant differences in the number of appendicular abscesses or peritonitis identified. So, these results are at the expense of an increase in gangrenous or perforated appendicitis.

At the beginning of the COVID-19 pandemic, recommendations were for the preference of open surgery over laparoscopic surgery. Over time, new studies have once failed to demonstrate the superiority of open surgery. This fact explains the lack of decrease in laparoscopic surgery in the COVID-19 year.

On the other hand, we believe that the increasing experience on laparoscopy surgery in the department aided to augment the use of laparoscopic surgery. Also, we believe that in presence of an experienced laparoscopy's surgeon, the shorter exposure time to virus during laparoscopic surgery may be one of the reasons for its choice in the COVID-19 pandemic period.

The authors found a decrease with significant statistic in the conversion of laparoscopy to open surgery between the groups, with lower number in the 2nd group.

During this period, we assisted to an increase of open surgery through a median laparotomy. These surgeries were done in the first months of the COVID-19 pandemic, when we didn't know a lot about the virus and when we believed that the open surgery was a better option *vs.* laparoscopy surgery. We verified that the cases of peritonitis were more frequent in the first months too. These two reasons can explain the increase in the median laparotomy in the year "COVID-19" with significant statistic different.

The authors concluded that an increase in postoperative complications in the COVID-19 year group was not verified and no statistically significance was substantiated, despite the greater severity at initial presentation in this group.

There are no statistically significant differences in the number of reoperations and readmissions between the groups, despite greater severity at initial presentation in the 2nd group.

The length of hospital stay was similar between both groups, with no statistically significant differences between them.

Limitations

The study was carried out in a retrospective manner and may present small inconsistencies in the diagnostic coding and its

postoperative complications. In addition, it was carried out in just one hospital unit, so there may be a selection bias, and these data can only reveal the results of this department.

Therefore, we believe that the study should be extended to other hospital units to obtain more accurate data and results.

Conclusion

The impact of the COVID-19 pandemic was manifested in a decrease in the total number of patients diagnosed with acute appendicitis, an increase in severity of the initial presentation and in the increase of cases of complicated acute appendicitis.

As to the outcome, there was no increase in postoperative morbidity or mortality during this period, with similar hospitalization durations, number of readmissions and reoperations.

Laparoscopic surgery was more used during the COVID-19 pandemic, but without a significant increase face the other period, and the conversion rate to open surgery was significantly lower. In regard to open surgery, during COVID-19 pandemic the median laparotomy approach was significantly higher.

We believe that the extension of this study to other hospitals in the country or even worldwide may assess the real impact of the COVID-19 pandemic, in one of the most frequent surgical pathologies of the emergency department.

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