

Delayed diagnosis and subsequently increased severity of acute appendicitis (compatible with clinical-pathologic grounds) during the COVID-19 pandemic – an observational case-control study.

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Abstract:

Background: During a global crisis like the current COVID-19 pandemic, delayed admission to hospital in cases of emergent medical illness may lead to serious adverse consequences. We aimed to determine whether such delayed admission affected the severity of an inflammatory process regarding acute appendicitis, and its convalescence.

Methods: In a retrospective observational cohort case-control study, we analyzed the medical data of 60 patients who were emergently and consecutively admitted to our hospital due to acute appendicitis as established by clinical presentation and imaging modalities, during the period of the COVID-19 pandemic (our study group). We matched a statistically control group consisting of 97 patients who were admitted during a previous 12-month period for the same etiology. All underwent laparoscopic appendectomy. The main study parameters included intraoperative findings (validated by histopathology), duration of abdominal pain prior to admission, hospital stay and postoperative convalescence (reflecting the consequences of delay in diagnosis and surgery).

Results: The mean duration of abdominal pain until surgery was significantly longer in the study group. The rate of advanced appendicitis (suppurative and gangrenous appendicitis as well as peri-appendicular abscess) was greater in the study than in the control group (38.3 vs. 21.6%, 23.3 vs. 16.5%, and 5 vs. 1% respectively), as well as mean hospital stay.

Conclusions: A global crisis like the current viral pandemic may significantly affect emergent admissions to hospital (as in case of acute appendicitis), leading to delayed surgical interventions and its consequences.

Background

Acute appendicitis is considered one of the most common abdominal emergencies. The etiology is diverse and not always clear, and include mucosal ulceration due to enteric infection, foreign bodies, ischemia, and luminal obstruction. Has been reported that short delay until appendectomy, as well as early antibiotic treatment for acute appendicitis, may postpone surgical intervention for a while . However, timing of surgery for appendicitis is of paramount importance as significant delay may lead to progression of the inflammatory process, propagating from acute catarrhal appendicitis to suppurative (phlegmonous), gangrenous and perforated appendicitis, and abscess formation, a possibility of peritonitis and sepsis .

As the differential diagnosis is wide, accurate assessment is important to prevent delayed diagnosis that could be detrimental, especially in the elderly with comorbidities . The preferred and most accurate imaging modality for appendicitis is abdominal computed tomography (CT).

The present COVID-19 pandemic raised deep concerns in the general population as arrival at a hospital could expose people to the viral disease. Fears of being infected has affected behavior even in the presence of a medical necessity. Recent publications have recently addressed the issue of appendicitis during the viral pandemic . Several studies have demonstrated reduced admission rate of acute appendicitis due to preferring conservative care by antibiotic treatment at home for mild inflammation . Others have shown increased ratio of advanced inflammatory process during the pandemic due to significant admission delay, most probably due to psychological effect.

Aim

We enrolled this retrospective study to show the effects of delayed admission of emergent cases during the COVID-19 pandemic on the severity of the disease, supported by meticulous validation of the clinical presentation with histopathologic findings .

Methods

A retrospective observational cohort study of all the patients above 18 years old, who were admitted to the Department of Surgery of Galilee Medical Center, Nahariya with acute appendicitis that was validated by clinical presentation and imaging modalities (the inclusion criteria).

The study group - patients admitted during the main surge of the COVID-19 pandemic (March 1st to June 30th 2020). The control group- patients who were treated for acute appendicitis during a 12 -month period prior to the Corona pandemic (January to December 2019).

The patients' medical files were meticulously explored for medical, laboratory data ,time elapsed till admission, intraoperative findings, the surgical approach, the type and duration of antibiotic treatment, hospital stay, perioperative complications, pathological, and imaging analysis. All the surgical interventions were done through the laparoscopic approach. Every gross presentation of the inflamed appendix was validated intra-operatively by an attending and a senior surgeon. All the histopathology findings of the resected specimen were re-evaluated and validated during the conduction of this research by two senior pathologists, for a better definition of the intra-operative findings in cases of controversy.

- Statistical analysis:

We used the IBM software SPSS version 25 for statistical analysis. Descriptive statistics in terms of mean, standard deviation (SD), median, and 25-75 percentiles were performed for all the data parameters. Normal distributions of the quantitative parameters were calculated by the Kolmogorov-Smirnov test. According to the results, we used the parametric t-test or the non-parametric Mann Whitney U test to define differences between the time periods. We used Fisher's exact test to compare categorical parameters of the two groups. A p-value less than 0.05 was considered statistically significant.

Results

Study group - 60 patients were presented to our department of surgery suffering acute appendicitis. Control group - 97 patients suffering from acute appendicitis were admitted .The mean age and F/M ratio of both groups did not differ statistically ($p=0.19$, Fisher's exact test) , as well as the clinical presentation and laboratory analysis. The mean duration of abdominal pain until surgical intervention (laparoscopic appendectomy) was 2.56 ± 1.53 days in the study group and 1.71 ± 1.39 days in the control group ($p=0.001$, 2-tail Fisher's exact test).

We have noticed significantly higher rates of phlegmonous (suppurative) rates (as demonstrated during surgery and supported by histopathologic analysis) in the study group, compared to the control group. The proportions of mild (catarrhal) appendicitis were less, as compared with the control group. Regarding the proportions of gangrenous appendicitis and peri-appendicular abscess, it was noticed to be much higher in the study group, although not reaching statistical significance, probably due to relatively small numbers of participants (Table no.1). Hospital stay was longer in the study compared to the control group (3.08 ± 1.57 days vs. 2.7 ± 1.51 days, $p=0.07$, one-tailed Fisher's exact test). No peri-operative complications were recorded in both two groups.

Table 1. Demographic and clinical characteristics, and intrabdominal findings of patients who underwent laparoscopic appendectomy for acute appendicitis, during the COVID-19 pandemic (Study Group), and during a 12- months of the Control Group.

	Study Group; n=60	Control Group; n=97	P value
Age	33.0±15.9	38.4±16.9	P=0.19
Gender			
Male	50%	54	P=0.80
Female	50%	46%	
Catarrhal inflammation	23 (38.3%)	59 (60.8%)	P=0.008
Phlegmonous (suppurative)	23 (38.3%)	21 (21.6%)	P=0.028
Gangrenous	14 (23.3%)	16(16.5%)	P=0.30
Peri-appendicular abscess	3 (5%)	1(1.03%)	P=0.15
Hospital stay (days)	3.08±1.57	2.75±1.51	P=0.19
Duration of antibiotic treatment (days)	3.56±2.08	3.39±1.85	P=0.74
Duration of abdominal pain until surgery (days) Median :25-75%	2.56±1.53	1.71±1.39	p<0.001

Discussion

This case-control study demonstrated the profound psychological effect of a viral crisis (the Corona COVID-19 pandemic) on patients who necessitated advanced medical (surgical) help in the hospital. Specifically, proper treatment (surgical intervention for acute appendicitis) was significantly delayed, as reflected by prolonged pre-admission time period of abdominal pain. We focused on intraoperative findings and clinical parameters that reflect delay in seeking medical attention. Our assumptions were clearly validated by demonstrating significantly increased ratio of phlegmonous (suppurative) appendicitis in the study group, correlating with duration of pre-admission pain. Gangrenous changes and abscess formation also clearly presented increased (although not significant) rate during the COVID-19 pandemic.

In comparison to recent publication regarding this topic, our results were precisely validated and were congruent with histopathology workup. For example, we approved suppurative appendicitis only following demonstration of inflammatory infiltrate and micro abscesses all-over the appendix wall. The mean length of hospital stay was significantly longer in the COVID-19 group. The findings demonstrate that psychological motives (which may be based on solid evidence regarding the risk of viral infection) may affect (and overcome) medical rationale. The upshot is significant delay in receiving proper medical and surgical care.

Conclusions:

Understanding the issue of such viral pandemic regarding acute abdominal pain and appendicitis should help promote proper dissemination of information by conventional and social media networks, thus increasing timely treatment. Ultimately, avoiding such postponements reduces the time patients spend in the hospital, which is the motive behind it.