

Acute appendicitis: Covid-19 pandemic did not change presentation and treatment



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AIM: This single-tertiary non-Covid center retrospective study analyses the impact on Covid-19 pandemic on the presentation and the treatment in patients operated for acute appendicitis.

METHODS: Total number of 152 patients operated for acute appendicitis in two separate periods (April – August 2019, and April – August 2020), were subjected to retrospective analysis. Patients were divided in two groups: pre-pandemic Group A and pandemic Group B.

RESULTS: Eighty one patient was operated in the pandemic period and the rest 71 one year ago in the same period. Preoperative C-reactive protein levels presented statistically higher in the pandemic group ($p = 0.0455$). Time from admission to surgery was shorter in the pandemic group (7.5 ± 4.6 vs 5.8 ± 4.9 ; $p = 0.0155$). Overall operative time and the laparoscopic operative time were statistically longer in the pandemic group (68.8 vs. 76.8 minutes; $p = 0.039$ and 60.04 vs 74.0 minutes; $p = 0.0141$, respectively). Complicated appendicitis rates were similar, although periapudicular abscess was more common in the pandemic group, but without statistical significance. Length of stay was shorter in the pandemic group ($p = 0.53$).

CONCLUSION: Our data showed that during the Covid-pandemic, acute appendicitis surgery is safe and feasible with results equal to the pre-pandemic period.

KEY WORDS: Appendicitis, Appendectomy, Covid

Introduction

After the declaration of the pandemic by the World Health Organization due to the spread of Corona virus 2 (SARS-CoV-2) in March 2020¹, certain Covid-19 measures were inevitable and necessary due to the pandemic control and the avoidance of overloading the health systems all over the world.

At the same time, consistency had to be maintained in the treatment of emergency surgical conditions such as the acute appendicitis as one of the most common emergencies².

The Government in our country took appropriate measures, part of them referred to the national health system with reorganization of the duties in the surgical facilities. Our surgical institution was in charge of treating emergency abdominal, trauma and neurosurgery cases of non-Covid patients in the period of April – August 2020, while the elective benign surgical conditions were postponed. Also, patients from other cities were referred to our clinic since many hospitals were transferred into Covid-19 treatment medical centers. Patients with Covid-19 that required emergency surgery were treated into another center in our capital.

This retrospective study analyzes the impact of the implemented measures on the acute appendicitis surgical treatment in our institution.

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Methods

Retrospective analysis of 152 patients operated in our Tertiary referral and educational University Clinic for Surgery for acute appendicitis was conducted. The analysis encompassed patients operated in the time period during the pandemic measures from April – August 2020 and the patients operated in the same period one year before the Covid-19 measures.

Epidemiologic questionnaire and body temperature measurement was conducted prior the examination in the emergency department. All patients underwent physical examination, routine blood test and ultrasound or computerized tomography. After admission, real-time polymerase chain reaction (RT-PCR) test was performed. PCR test time for analysis did not delayed the surgical treatment.

Patient demographics (sex, age), American Society of Anesthesiology Score (ASA), laboratory results (Leucocyte count and C-reactive protein – CRP), time from admission to surgery, type of surgery (open, laparoscopic and converted), operative time, intraoperative findings, conversion rate and length of stay were analyzed between the two groups of patients (pre-pandemic and pandemic group). Cases of complicated appendicitis presented as periappendicular abscess and diffuse peritonitis were analyzed separately from gangrenous and perforated appendicitis since they are the most severe form.

Medical data was extracted from the National Health System and the University Clinic archive.

STATISTICA v. 12.0 for Windows was used for statistical data analysis. Descriptive statistical methods were used for data presentation (mean, standard deviation – SD, median, percentage). Parameter normality was tested with Kolmogorov-Smirnov Test. Student's t-test for two independent means and Mann-Whitney U test were used for numerical parameters, while Chi square and Fisher exact test were used for categorical data analysis depending on the sample size. Value of $p < 0.05$ was considered as statistically significant.

Results

Ninety seven male and 55 female patients (63.8% and

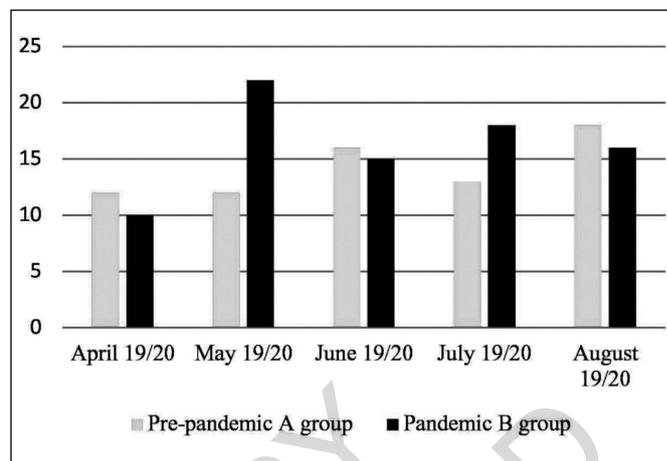


Fig. 1: Appendectomies per month in 2019/2020.

36.2%, respectively) with preoperative diagnosis of acute appendicitis were operated in the study period (71 in the pre-pandemic - group A and 81 in the pandemic – group B). Number of performed appendectomies in the two separated periods with monthly distribution were: April (12/10), May (12/22), June (16/15), July (13/18) and August (18/16) and are shown in Fig. 1.

Male median age was 34.6 (range 6 – 83), and female median age was 31.9 (range 7 – 76). There was statistically non-significant male predominance in both groups (Table I).

Analyzed ASA score and preoperative leucocyte count were similar in both groups. CRP level presented statistically higher in the pandemic group B (64.38 ± 70.10 vs. 97.08 ± 95.54 ; $p = 0.0455$). Also, the time from admission to surgery was statistically shorter for the pandemic group (7.5 ± 4.6 vs 5.8 ± 4.9 ; $p = 0.0155$). Preoperative patient data are shown in Table II.

Seventy one patient was operated in the pre-pandemic and 81 in the pandemic period which accounts for 13.1% increase in the Covid-pandemic period. Laparoscopic appendectomy was performed in 75 patients, open in 71 and in 6 of them, converted appendectomy was forced.

One patient SARS from the laparoscopic group was tested positive for SARS-CoV-2. He was properly isolated during his postoperative hospital stay and released on postoperative day 3 with mild Covid-19 symptoms.

TABLE I – Demographic characteristics

Characteristics	Group A (2019)	Group B (2020)	p value
Number of patients	71	81	–
Age, years (mean \pm SD)	35.50 ± 17.49	32.13 ± 16.86	$p = 0.2288$ ($t = 1.2083$)
Age, range	8 – 83	6 – 75	–
Male, n (%)	47 (66.2 %)	50 (61.7%)	$p = 0.5673$
Female, n (%)	24 (33.8%)	31 (38.3%)	($X^2 = 0.3272$)

TABLE II – Preoperative patient data

Parameters	Group A (2019)	Group B (2020)	p value
ASA score (n)			
1	37	47	$p = 0.4979$
2	26	29	$X^2 = 1.3946$
3	8	5	
CRP mg/L (mean ± SD)	64.38 ± 70.10 (median 32.2)	97.08 ± 95.54 (median 58.1)	$p = 0.0455$ $z = 1.9978$
Le x10 ⁹ /L (mean ± SD)	13.57 ± 3.85 (median 13.8)	14.63 ± 4.81 (median 15.1)	$p = 0.1424$ $t = -1.4743$
Time from admission to surgery/hours	7.5 ± 4.6 (median 6)	5.8 ± 4.9 (median 5)	$p = 0.0155$ $z = -2.4225$

TABLE III - Operative data

Parameters	Group A (2019)	Group B (2020)	p value
Type of surgery			
Laparoscopic	23 (32.4%)	52 (64.2%)	
Open	45 (63.4%)	26 (32.1%)	
Converted	3 (4.2%)	3 (3.7%)	
Operative time/minutes (all procedures)	68.8 ± 24.06 (median 65)	76.8 ± 23.3 (median 72)	$p = 0.0391$ $t = -2.0811$
Operative time (laparoscopy)	60.04 ± 24.02 (median 55)	74.01 ± 21.36 (median 70)	$p = 0.0141$ $t = -2.514$
Operative time (open procedure)	72.24 ± 23.42 (median 73)	76.92 ± 19.81 (median 77.5)	$p = 0.39$
Complicated appendicitis rate n (%)	30 (42.25%)	39 (48.14%)	$p = 0.46$
Periappendicular abscess rate n (%)	2 (2.8%)	9 (11.1%)	$p = 0.06$
Diffuse peritonitis rate n (%)	10 (14.08%)	12 (14.81%)	$p = 0.89$ $X^2 = 0.016$
Other findings	2 (2.8%)	2 (2.8%)	$p = 1$
Converted appendectomy n (%)	3 (4.2%)	3 (3.7%)	$p = 0.86$
Length of stay/days (mean ± SD)	4.5 ± 1.99	4.2 ± 1.85	$p = 0.5352$ $z = -0.6204$

Overall operative time for all the procedures was statistically longer in the pandemic group B (68.8 vs. 76.8 minutes; $p = 0.039$). Separated analysis for the laparoscopic procedures also revealed statistically significant longer operative time in the pandemic group (60.04 vs 74.0 minutes; $p = 0.0141$). High rate of complicated appendicitis presented in both groups (42.25% for Group A and 48.14% for Group B; $p = 0.46$).

Diffuse peritonitis was present in 22 patients, 10 in Group A and 12 in Group B ($p = 0.89$), and periappendicular abscess was more common without reaching statistical significance in the pandemic group B (2 vs. 9, $p = 0.06$). Additional analysis for those 9 patients with periappendicular abscess from the pandemic group (only those operated laparoscopically), revealed conversion rate of 50% (Table III).

Other findings were diagnosed intraoperatively in 4 patients (two with ovarian cyst rupture, one with mesen-

teric lymphadenitis and one with low-grade appendicular mucinous neoplasm).

Discussion

Reports of decreased number of patients presented with acute appendicitis in the year of 2020 (fewest admissions in April 2020) are published. Also, the number of emergency admissions for acute appendicitis dropped in range from 1.75% to 84%³. Tankel also reports decreased incidence of acute appendicitis in a retrospective cohort analysis for 40.7% in a 7-week period⁴.

The main reason for decreased number of patient visits in the emergency departments pointed on the fear from SARS- CoV-2 infection in the Covid outpatient medical facilities^{5,6}.

In order to advise surgeons in providing the best care

for emergency surgical patients, and at the same time optimize patient care resources, some countries announced guidelines for triage of emergency surgery patients in the pandemic period. In terms of uncomplicated appendicitis treatment, this guidelines advised surgeons to use antibiotics as the first-line treatment, and appendectomy consideration in cases of symptom worsening or recurrence. Recommendation for IV antibiotic in cases of complicated appendicitis was also offered as a treatment option, while in those with periappendicular abscess and perforation, percutaneous drainage or surgery was recommended⁷.

Our surgical facility as long-standing emergency and elective Tertiary educational center has been treated abdominal emergencies for years, including acute appendicitis. During the pandemic period, the imposed but necessary reorganization resulted in increased number of visits in our outpatient emergency department, not only with patients from our capital, but also from other cities where emergency departments were transformed in Covid emergency departments.

Our results showed that the number of appendicitis-related admissions and the number of performed appendectomies in the Covid-pandemic period was increased for 13.1% in comparison with the same period one year ago. Recommendations on changing the modality for acute appendicitis treatment were not issued by the Macedonian health authorities. Therefore, as non-Covid surgical center, all cases were operated when indication was set.

Reported CRP levels in patients with acute appendicitis presented in the Covid time vary from studies without difference when compared with non-Covid periods⁸⁻¹², to other in whom the level of CRP was significantly higher in the Covid-groups¹³. Our study also presented significantly higher preoperative CRP level in the pandemic period group.

Reports for statistically significant prolonged period from admission to surgery and preoperative assessment have been published^{9,10}. Due to the high frequency of admissions and the increased number of overall surgical procedures during the Covid pandemic in our clinic, elective benign procedures were postponed. This created a possibility for effective post admission organization and patient preparation for surgery. It resulted in effectiveness expressed through significant decrease of the time from admission to surgery comparing with the pre-pandemic period.

Laparoscopic appendectomy was the predominant procedure in the pandemic group contrary to the pre-pandemic, whereas more than 60% of the appendectomies were open ones. The choice for the type of surgery depended mostly on the surgeon's preference that was on duty at given time. Senior surgeons in our clinic have preference for open appendectomy. Their emergency rounds were reduced due to the high risk for severe Covid pneumonia, so the junior ones preferred the

laparoscopic access. Also, the medical staff effort was maximal in providing hospital stay shortening for minimizing the risk of intra-hospital infection with SARS-CoV-2 of the operated patients.

The duration of operative time in the pandemic era varies. Zhou reports no difference in operative time in 2019 and 2020, same period¹³. Ho reports longer operative time in the pandemic but without statistical significance¹⁴. Finkelstein reports statically significant longer operative time in the Covid-19 pandemic ($p = 0.01$)¹⁵.

The overall duration of the procedures in our study was significantly longer in the pandemic group. The laparoscopic appendectomies were also significantly longer.

Reported rates of complicated appendicitis in the pandemic era are showing increasing trend of complicated appendicitis rates, explained with late presentation in the emergency departments¹⁵⁻¹⁸.

On the other hand, Tankel and Köhler do not report increased rate of complicated appendicitis in the pandemic^{4,19}.

Rate of complicated appendicitis in our study was high in both groups. No differences were noted in the pandemic as it was expected. This might be explained with delayed referral in hospital due to other non-pandemic causes.

Length of stay in this study did not show statistical difference between the two groups.

LIMITATIONS

This is a single-center study. Although we operate a large number of patients with acute appendicitis per year, we must consider the presence of other two surgical centers in our capital. One of them was transformed into Covid center and emergency surgery was performed only for Corona positive patients, while the other was treating emergencies like we did.

Conclusion

Covid-pandemic had serious impact on healthcare systems and it has altered the way surgical management worldwide²⁰. It also reflected on the emergency surgical procedures in the world. In our study, its negative impact was demonstrated through higher CRP levels and higher incidence of periappendicular abscess. However, there was no worsening in the postoperative outcome regarding the laparoscopy conversion rate and the length of stay.

Best way of protecting the operated patients from intra-hospital infection with SARS-CoV-2 is treating them in non-Covid surgical facilities. This measures enabled almost all of our operated patients to be discharged from hospital Covid-free.

At the beginning of the pandemic, surgeons had ten-

dency for treating acute appendicitis with antibiotics and close follow-up. Contrary, our data showed that during such pandemic, acute appendicitis surgery is safe and feasible with results equal to the pre-pandemic period.

Riassunto

Questo studio retrospettivo dell'esperienza di un singolo centro terziario non Covid analizza l'impatto della pandemia di Covid-19 sulla presentazione e il trattamento in pazienti operati per appendicite acuta.

Sono stati sottoposti ad analisi retrospettiva un numero totale di 152 pazienti operati per appendicite acuta in due periodi separati (aprile – agosto 2019 e aprile – agosto 2020) suddividendo i pazienti in due gruppi: Gruppo A pre-pandemia e Gruppo B pandemico.

Risultati: Ottantuno pazienti sono stati operati nel periodo della pandemia e il resto 71 l'anno precedente nello stesso periodo. I livelli preoperatori di proteina C-reattiva si sono presentati statisticamente più alti nel gruppo pandemico ($p = 0,0455$). Il tempo dal ricovero all'intervento è stato più breve nel gruppo pandemico ($7,5 \pm 4,6$ vs $5,8 \pm 4,9$; $p = 0,0155$). Il tempo operatorio complessivo e il tempo operatorio laparoscopico erano statisticamente più lunghi nel gruppo pandemico ($68,8$ vs $76,8$ minuti; $p = 0,039$ e $60,04$ vs $74,0$ minuti; $p = 0,0141$, rispettivamente). I tassi di appendicite complicata erano simili, sebbene l'ascesso periappendicolare fosse più comune nel gruppo pandemico, ma senza significatività statistica. La durata della degenza è stata più breve nel gruppo pandemico ($p = 0,53$).

Conclusione: i nostri dati hanno mostrato che durante la pandemia di Covid, l'intervento chirurgico per appendicite acuta è sicuro e fattibile con risultati pari al periodo pre-pandemico.

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