Has the Covid-19 Pandemic increased the complication rate in patients with acute appendicitis?

Ann Ital Chir, 2023 94, 2: 209-213
pii: S0003469X23038812
Online ahead of print 2023 - Jan. 9
free reading: www.annitalchir.com

Ahmet Gürer, Nermin Damla Okay, Öner Deniz Aslan, Serdar Gökay Terzioğlu, Mehmet Özer, Tolga Dinç

Department of General Surgery, Ankara City Hospital, Ankara, Turkey

Has the Covid-19 Pandemic increased the complication rate in patients with acute appendicitis?

AIM: *The aim of this study is to compare the numbers of patients, clinical outcomes, and complication rates of acute appendicitis before and after COVID-19 pandemic in our clinic.*
MATERIAL AND METHOD: *This is a retrospective clinical study. Patients of 19 to 88 years of age that underwent emergency surgery with the diagnosis of acute appendicitis at Ankara City Hospital Department of General Surgery between 11 December 2019 and 11 June 2020 were included. The first case of COVID-19 in Turkey was announced on 11 March 2020. We studied the demographics, surgical procedures, and complication rates in 3 months periods before and after the first case was announced.*
RESULTS: *A total number of 462 patients were analyzed between the ages of 19-88, 184 of which (39.8%) were females and 278 were males (60.2%). 253 of these patients were diagnosed with AA and underwent surgery before March 11 whereas 209 patients were diagnosed and treated after March 11.*
DISCUSSION: *There was no statistical difference between the two groups in terms of complication rates before and after the pandemic. Although the rate of open appendectomy was increased after the pandemic, no statistical difference has been found.*
CONCLUSION: *No change was observed in terms of hospital admissions, methods of treatment, complication rates, length of stay before and after the COVID-19 pandemic.*

KEY WORDS: Acute Appendicitis, Appendectomy, COVID-19

Introduction

Approximately 5-10% of emergency department admissions are acute abdomen cases [1]. Acute abdomen cases have a wide range of presentation ranging from moderately life threatening to severely life-threatening conditions [2]. Acute appendicitis (AA), is a common cause of acute abdomen [3]. In fact, AA is the most common cause of acute abdomen in all age groups [4,5]. 4.5% of all abdominal pain is caused by AA [6]. Delays in making a diagnosis can cause a variety of complications, which could potentially cause serious morbidity and mortality [7]. AA can be classified into two groups; complicated and non-complicated. Presence of abscess, phlegmon, gangrene, perforation indicates complicated appendicitis [8,9]. Main reasons for complications to occur are delays in either admission, or reaching a definitive diagnosis. Complicated AA cases can cause labor loss in healthcare and increase costs.

The first COVID-19 case in Turkey was identified on 11 March 2020. Similar to most other countries, raising number of COVID-19 cases increased the workload in our healthcare system. Concerns have been voiced regarding whether the focus on COVID-19 has caused delays in diagnosing certain conditions and therefore lead to complications [10]. On this basis, we aimed to compare the characteristics and management of AA cases before and after COVID-19.

Pervenuto in Redazione Agosto 2022. Accettato per la pubblicazione Ottobre 2022
Correspondence to: Assoc. Prof Dr Ahmet Gürer, (e-mail: drahmetgurer@hotmail.com)

In our study, we have divided patients that presented to the emergency department with AA into two groups; patients that presented to the hospital within 12 weeks before COVID-19 and 12 weeks after COVID-19. We aimed to compare the clinical features and histopathological diagnoses of the two groups.
In addition, we aimed to compare the number of presentations of AA before and after COVID-19.

Material And Method

This is a retrospective clinical study, which is approved by Ankara City Hospital Ethical Committee on June 09, 2021, and issue E1-21-1874. This study was also approved by the Turkish Ministry of Health on June 04, 2021, and issue T12_19_48. Patients of 19 to 88 years of ages who were admitted to Ankara City Hospital Surgical Emergency Ward between 11 December 2019 and 11 June 2020 with the provisional diagnosis of AA and underwent surgery, and had a pathologic diagnosis of AA were included in the study. Data on the demographics (age, sex, patient protocol number), full blood count (white blood cells, hemoglobin, platelets, hematocrit), biochemistry parameters (amylase, direct bilirubin, indirect bilirubin, albumin, calcium, lactate dehydrogenase (LDH), comorbidities (diabetes, hypertension, heart disease, kidney disease, asthma, chronic obstructive pulmonary disease (COPD), surgery types (open, laparoscopic) of the patients were recorded. Patients were divided into two groups; those who were hospitalized 12 weeks before and after 11 March 2020.
There are also two subgroups based on pathologic diagnoses; complicated and non-complicated. Patients that underwent surgery for AA with pathology results indicating inflammatory bowel disease or malignancy were excluded.

Statistical Analysis

Descriptive statistics for categorical variables were presented as frequency (percentage), and for numerical variables as median (minimum-maximum).
Normality assumption for numerical variables was assessed with Kolmogorov-Smirnov Test. To assess the decline in the number of hospital admission, Chi-Square Goodness of Fit Test was used. Variables between the time periods (before and after 3/11) were compared using Chi-Square test for categorical variables and Mann Whitney U test for numerical variables. Statistical analysis was made using Statistical Package for Social Sciences (SPSS, SPSS Inc. Version 11.5, Chicago, IL) and p value of <0.05 was accepted as statistically significant.

Results

Between the ages of 19-88, 184 female (39.8%) and 278 male (60.2%) with a total number of 462 patients were included. 253 of the patients were diagnosed with AA and operated before March 11 (Group 1), and 209 were diagnosed and operated after March 11 (Group 2). Although there is an increase in the number of complications (abscess, phlegmon formation, gangrene, perforation) after COVID-19, there is no statistical difference between Group 1 and 2 in terms of complicated and non-complicated cases. Likewise, after the pandemic the number of open appendectomies was found to be increased with no statistical difference between two groups.
Pathology results of the 462 patients showed 139 abscess or phlegmon formations, 22 perforations, and 32 gangrenous appendicitis. These patients were categorized as complicated cases. The remaining 269 patients were classified as non-complicated cases. Group 1 had 1.88 days of average hospital stay time while Group 2 had 1.79. Preoperation average white blood cell count of Group 1 was 13100/μL compared to 12900/μL of Group 2. Those who had an ultrasound scan in Group 1 had an average of 9.5 mm appendix diameter whereas Group 2 had an average of 9.9 mm. Similarly, those who had a CT scan in Group 1 had an average of 11 mm appendix diameter while Group 2 had an average of 10.8 mm. Analysis of these parameters showed no statistical difference between group 1 and 2.

Discussion

AA is the most common general surgical emergency. Parallel to many parts of our daily lives, COVID-19 has made some important changes in hospital admissions, diagnosis and treatment protocols. We have investigated that whether the total number of AA cases and their complication rates were increased before and after the pandemic.
A study conducted in Australia retrospectively assessed appendectomies during COVID-19, and compared the incidence of complicated appendicitis cases of the same this period with the long term past data. The time period from 16 March to 5 May 2022 was taken into consideration when precautions such as closing of the borders and social distance were taken and said restrictions were relieved. As a result, no significant demographic difference was found. There was no change in the total number of acute appendicitis, and operative time and length of stay in hospital were found to be similar in each group [11]. Similarly, there was no decrease in the number of cases in our study. In contrast, a study conducted in Jerusalem showed a significant decrease in the number of AA cases before and during COVID-19. No statistical difference was found in terms of preoperative

symptoms, duration of surgical intervention, postoperative peritoneal drainage requirements, and complication status of AA cases between groups [6]. Turanli et al. assessed the data of patients that underwent appendectomy between 1 June 2019 and 1 June 2020 in 3 months periods before and after the pandemic. As a result, no increase in the number of perforated appendicitis was observed during COVID-19 [12]. Similar to these studies, in the study of Nikolovski et al., patients with appendectomy before the pandemic were compared with the patients during the pandemic period in the four-month period. Although high periappendicular abscess levels were detected in patients, it was concluded that the surgery was safe and the results were satisfactory. However, the limitations of the small number of patients and the uncertainty of whether the hospital functions as a pandemic hospital should also be considered [13].

Contrary to aforementioned studies, Finkelstein et al. compared the rates of AA and perforated AA during the lockdown from March to May 2020 with the same time period of the previous year. Perforated appendicitis rates were found to be increased during the quarantine compared to the previous year. Length of hospital stay, operative time, and complication rates were also found to be increased in patients with perforated appendicitis [14].

In the study conducted by Frediani et al, it was concluded that the surgery of the patients with appendicitis in the pediatric profile in accordance with the Covid-19 protocols protects the hospital personnel and is beneficial for the patient. Appendicitis patients participating in our study were also safely operated in the appropriate operating room, following the Covid-19 protocols. The results were reported as similar to the pre- and post-Covid-19 period [15].

A study conducted in Brazil from March to April 2020 retrospectively compared the data of the patients with AA that underwent surgery with the same time period in the previous year. During the pandemics, the total number of appendectomies decreased by 56%. The average time between symptom onset and hospital admission was found to be significantly increased in 2020. The number of complicated AA cases was also higher compared to the previous year. There was no statistical difference between the groups in terms of postoperative complications and length of stay [16].

A multicenter study in Germany consisting of 41 surgical departments and 1915 patients with AA, showed that the total number of performed appendectomies decreased by 13.5% in the first quarantine period of COVID-19 in 2020 compared to 2019. The delay between symptom onset and medical consultation was considerably longer in patients with COVID-19 and the elderly. Although complicated AA rates increased (from 58.2% to 64.4%), the total number of complicated AA cases decreased (from 597 to 569). Negative appendectomy rate substantially decreased (4.6% - 6.7%). No changes in postoperative morbidity and mortality were observed [17]. Another study conducted in Switzerland consisting of 306 patients assessed 65 patients during COVID-19 in 2020 (group A), and 241 patients before the pandemic (group B). Total number of consultations of AA during pandemics decreased by an approximate of 20% compared to previous years. A significant increase in complicated AA rate was observed (52% in group A vs. 20% in group B). Comparing group A and B respectively, other differences were also observes in terms of duration of symptoms (lasting longer than 48 hours; 61% vs. 26%), intervention time (77 vs. 61 minutes), length of hospital stay (longer than 2 days; 63% vs. 32%), and length of antibiotic treatment (antibiotics > 3 days 36% vs. 24%). It was stated that increase in the number of complicated AA cases and decreased number of consultations were most likely due to delays in hospital admissions during the pandemic [18]. In our study, although there is a decline in the total number of hospital admissions and appendectomies, no statistical difference was found. This decline could be due to the fact that most patients with COVID-19 were admitted to our hospital, leading patients requiring operation to consider having surgery in a different center.

Complication rates were found to be increased, with no statistical difference. This could indicate that hospital admissions were delayed potentially due to restrictions and worries. In the early stages, laparoscopic appendectomy is considered to be the gold standard for AA worldwide. However, during the COVID-19 pandemic aerosol-generating procedures prompts concern regarding perioperative mortality and infection spread. This begs the question of whether complication rates have increased due to delays in hospital admissions, and should effective alternative treatment modalities to laparoscopic appendectomy be considered. There are many other studies globally similar to our research. A study in the United Kingdom consisting of 500 patients from 48 different regions analyzed the effect of the pandemic on the management of AA between 23 March 2020 and 1 May 2020. 271 patients (54%) were initially managed conservatively; with only 26 (10%) cases requiring surgery. 44% (93/211) of the patients had laparoscopic appendectomy. Median length of stay was substantially lower in the group that conservative management was the preferred course of action. Within 30 days, complication rates were significantly higher in the group that underwent surgery ($p < 0.001$) and no mortality was observed in each group. As a result, it was shown that COVID-19 has changed how AA has been managed and non-operative management was safe and effective in the short term. It was suggested that antibiotics could be considered as the first-line treatment during the pandemic and perhaps even after [19]. In another study in the United Kingdom during the pandemic that compared the results and effectiveness of conservative and operative management of AA, imaging was used more often and numer-

ous medical treatment methods were applied. Similar to our study, for patients that underwent surgery open appendectomy was preferred. Average length of stay was not changed however, intraabdominal abscess and fluid formation was observed more frequently intraoperatively [20]. In our study, the total number of laparoscopic appendectomies was lower however, no statistical significance was found. Being a reference hospital with a high density of patients before and after the COVID-19 pandemic, open appendectomy was the preferred approach to AA patients in our center. This could be associated with the fact that no statistical difference was observed between open and laparoscopic appendectomy numbers before and after the pandemic.

Conclusion

In this study, we have compared the patients that presented to the emergency department with acute appendicitis before and during COVID-19. Although the number of complicated AA cases was higher than non-complicated AA cases, no statistical significance was shown. Furthermore, no difference was found in the total number of patients that presented to the emergency department with AA. Multicenter studies that cover a longer period of time with a greater number of total patients are needed on this subject.

Riassunto

Lo scopo di questo studio è di confrontare il numero di pazienti, i risultati clinici e il tasso di complicanze dell'appendicite acuta prima e dopo la pandemia di COVID-19 nella nostra clinica.

Si tratta di uno studio clinico retrospettivo, in cui sono stati inclusi i pazienti di età compresa tra 19 e 88 anni che hanno subito un intervento chirurgico d'urgenza con diagnosi di appendicite acuta presso il Dipartimento di Chirurgia Generale dell'ospedale cittadino di Ankara tra l'11 dicembre 2019 e l'11 giugno 2020. Il primo caso di COVID-19 in Turchia è stato annunciato l'11 marzo 2020. Abbiamo studiato i dati demografici, le procedure chirurgiche e il tasso di complicanze nei 3 mesi precedenti e dopo l'annuncio del primo caso.

Il numero totale dei pazienti analizzati è stato di 462 pazienti di età compresa tra 19 e 88 anni, di cui 184 (39,8%) donne e 278 uomini (60,2%). In 253 di questi pazienti è stata diagnosticata una appendicite acuta e sono stati sottoposti a intervento chirurgico prima dell'11 marzo, mentre in 209 pazienti la diagnosi di appendicite acuta e relativo trattamento chirurgico sono stati successivi al 11 marzo.

Non è stata rilevata alcuna differenza statistica tra i due gruppi in termini di tasso di complicanze prima e dopo la pandemia. Sebbene l'incidenza di appendicite acuta è risultato aumentato dopo lo scoppio della pandemia, non è stata trovata alcuna differenza statistica.

CONCLUSIONE: Non è stato osservato alcun cambiamento in termini di ricoveri ospedalieri, metodi di trattamento, tasso di complicanze, durata della degenza prima e dopo la pandemia di COVID-19.

References

1. Pitts SR, Niska RW, Xu J, Burt CW: *National hospital ambulatory medical care survey: 2006 emergency department summary*. Natl Health Stat Rep, 2008; 7:1-38.

2. Ömeroğlu S: *The first case: Acute abdomen due to gastric gastrointestinal stromal tumor perforation with synchronous renal cell carcinoma.* Gülmez S, Bozkurt E: Ann Ital Chir, 2022; 11: September 20, PII: S2239253X22038117.

3. Khanapure S, Nagral S, Nanavati AJ*: A study of events between the onset of symptoms and hospital admission in patients with acute abdomen*. Natl Med J India, 2017; 30(2)65-8.

4. Ozguner IF, Buyukayavuz BI, Savas MC: *The influence of delay on perforation in childhood appendicitis. A retrospective analysis of 58 cases*. Saudi Med J, 2004; 25:1232-6.

5. Zhang Y, Zhao YY, Qiao J, Ye RH: *Diagnosis of appendicitis during pregnancy and peritoneal outcome in the late pregnancy*. Chin Med J, 2009; 122:521-4.

6. Tankel J, Keinan A, Blich O, Koussa M, Helou B, Shay S, Zugayar D, Pikarsky A, Mazeh H, Spira R, Reissman P: *The decreasing incidence of acute appendicitis during COVID-19: A retrospective multi-centre study*. World J Surg, 2020; 44:8:2458-63.

7. Vaziri M, Pazouki A, Tamannaie Z, Maghsoudloo F, Pishgahroudsari M, Chaichian S: *Comparison of pre-operative bilirubin level in simple appendicitis and perforated appendicitis*. Med J Islam Repub Iran, 2013; 27(3)109-12.

8. Andersson Re, Petzold MG: *Nonsurgical treatment of appendiceal abscess or phlegmon: A systematic review and meta-analysis*. Ann Surg, 2007; 246:741-8.

9. Simillis C, Symeonides P, Shorthouse AJ, Tekkis PP: *A meta-analysis comparing conservative treatment versus acute appendectomy for complicated appendicitis (abscess or phlegmon).* Surgery, 2010; 147:818-29.

10. Yildiz EO, Yildirim E, Orhun Erdoğan K, Eryilmaz I, Yünlüel Em, Yetiş F, UlukenT SC: *The effect of the Covid 19 pandemic on the number of patients treated for acute and complex acute appendicitis.* Ann Ital Chir, 2022; 11: Sept. 5, PII: S0003469X22037721.

11. Lee-Archer P, Blackall S, Campbell H, Boyd D, Patel B, Mcbride C: *Increased incidence of complicated appendicitis during the COVID-19 pandemic.* J Paediatr Child Health, 2020; 56:(8)1313-4.

12. Turanli S, Kiziltan G: *Did the COVID-19 pandemic cause a delay in the diagnosis of acute appendicitis?* World J Surg, 2021; 45; (1)18-22.

13. Nikolovski A, Ulusoy C, Dervishov K, Otljanski A**:** *Acute appendicitis: Covid 19 did not change the presentation and the treatment*. Ann Ital Chir, 2022; 93(3)369-73.

14. Finkelstein P, Picado O, Muddasani K, Wodnicki H, Mesko T, Unger S, Bao P, Jorge I, Narayanan S, Ben-David K: *A retrospective analysis of the trends in acute appendicitis during the COVID-19 pandemic.* J Laparoendosc Adv Surg Tech A, 2021; 31(3)243-46.

15. Frediani S, Pellegrino C, Bertocchini A, Aloi IP, Raponi M, Inserra A: *Appendicitis in Covid 19 pandemic Era. Early experience of an international referral center of pediatric surgery*. Ann Ital Chir, 2021; 92; (5)592-4.

16. Kumaira Fonseca M, Trindade EN, Costa Filho OP, Nácul MP, Seabra AP: *Impact of COVID-19 outbreak on the emergency presentation of acute appendicitis*. Am Surg, 2020; 86(11)1508-12.

17. Willms AG, Oldhafer KJ, Conze S, Thasler WE, Von Schassen C, Hauer T, Huber T, Germer CT, Günster S, Bulian DR, Hirche Z, Filser J, Stavrou GA, Reichert M, Malkomes P, Seyfried S, Ludwig T, Hillebrecht HC, Pantelis D, Brunner S, Rost W, Lock JF: *Camin Study Group*: *Appendicitis during the COVID-19 lockdown: Results of a multicenter analysis in Germany*. Langenbecks Arch Surg, 2021; 406(2)367-75.

18. Burgard M, Cherbanyk F, Nassiopoulos K, Malekzadeh S, Pugin F, Egger B: *An effect of the COVID-19 pandemic: Significantly more complicated appendicitis due to delayed presentation of patients*! Plos One, 2021; 16(5)e0249171.

19. Javanmard-Emamghissi H, Boyd-Carson H, Hollyman M, Doleman B, Adiamah A, Lund JN, Clifford R, Dickerson L, Richards S, Pearce L, Cornish J, Hare S, Lockwood S, Moug SJ, Tierney GM: *Covid: Harem (Had Appendicitis, Resolved/Recurred Emergency Morbidity/Mortality) Collaborators Group*: *The management of adult appendicitis during the COVID-19 pandemic: An interim analysis of a UK cohort study*. Tech Coloproctol, 2021; 25(4)401-11.

20. Antakia R, Xanthis A, Georgiades F, Hudson V, Ashcroft J, Rooney S, Singh AA, O'Neill Jr, Fearnhead N, Hardwick RH, Davies RJ, Bennet T JMH: *Acute appendicitis management during the COVID-19 pandemic: A prospective cohort study from a large UK centre*. Int J Surg, 2021; 86:32-7.