ORIGINAL ARTICLE
Turk J Surg 2022; 38 (2): 175-179

COVID-19 outbreak and acute appendicitis: Does the lockdown has a influence on appendectomies?-A single center retrospective cohort study

Sönmez Ocak, Ömer Faruk Bük, Mustafa Safa Uyanık, Ahmet Burak Çiftci

Clinic of General Surgery, Samsun Research and Training Hospital, Samsun, Türkiye

ABSTRACT

Objective: Healthcare systems have been negatively affected from COVID-19 pandemic worldwide. Elective surgical procedures were postponed and conservative treatment options were considered even in urgent conditions. This study aimed to explore the influence of the COVID-19 pandemic on urgent appendectomy in a pandemic hospital.

Material and Methods: Patients on whom appendectomy was performed between March 2020- June 2020 were included into the study (pandemic group). For comparison, control group patients were selected in the same period of 2019 (control group). Patients' demographics, laboratory and radiological findings, length of hospital stay, complications and histopathological findings of the groups were compared.

Results: Forty-six patients were included in pandemic group and and one hundred-one in the control group. Patient characteristics were similar in both groups. There were no significant differences in type of surgery, complications, laboratory and histopathological findings. In the control group, length of hospital stay was longer when compared with the pandemic group.

Conclusion: Although the number of appendectomies performed decreased significantly during the COVID-19 pandemic, perioperative parameters were similar in both groups

Keywords: Acute appendicitis, appendectomy, COVID-19, pandemic, lockdown

INTRODUCTION

Appendectomy for acute appendicitis (AA) is the most commonly performed emergency surgical procedure worldwide with very low mortality and morbidity rates (1). Due to the advancements in imaging techniques and accessibility of healthcare services, vast majority of the cases are uncomplicated (2,3).

Since the first COVID-19 case was reported from China, rapid spread of the disease resulted in a pandemic, and the first case was announced on 11 March 2020 in Turkey (4), and the government decided on complete lockdown following the recommendation of the Scientific Committee. Healthcare systems were negatively affected from the COVID-19 pandemic, elective surgeries were postponed for lightening both the burden of the hospitals and healthcare providers to prevent patients from suffering perioperative COVID-19 complications.

This retrospective case control study aimed to explore the influence of the COVID-19 pandemic on urgent appendectomy for AA in a pandemic hospital.

MATERIAL and METHODS

Study Design

This study was conducted retrospectively in Samsun Training and Research Hospital, following the approval of the local ethics committee (protocol number: GOKA/2021/11/11). Patients who underwent appendectomy between March-June 2020 period when the pandemic was at its peak were included as the pandemic group, and patients who underwent appendectomy in the same period in 2019 were included into the study as the control group. Inclusion criteria of the study were as follows:

Cite this article as: Ocak S, Bük ÖF, Uyanık MS, Çiftci AB. COVID-19 outbreak and acute appendicitis: Does the lockdown has a influence on appendectomies?-A single center retrospective cohort study. Turk J Surg 2022; 38 (2): 175-179.

Corresponding Author
Sönmez Ocak
E-mail: sonmezdr@gmail.com

Received: 14.07.2021
Accepted: 16.03.2022
Available Online Date: 29.06.2022

DOI: 10.47717/turkjsurg.2022.5440

1. Patients who were older than 18 years of age,
2. Patients who underwent appendectomy for diagnosis of acute appendicitis.

Exclusion criteria were as follows:

1. Additional surgical procedures with appendectomy,
2. Patients who were younger than 18 years of age or pregnant,
3. Inaccessibility of patients' data.

Study Parameters

Patients' demographics, laboratory and radiological findings, surgery details, length of hospital stay, complications and histopathological findings were recorded.

Diagnosis of AA and Surgery

The diagnosis of AA was made both clinically and radiologically. Choice of laparoscopic or open surgery depended on surgeon's preference. If there was no acute inflammation at histopathological examination, cases were considered as 'negative appendectomy'.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp, Armonk,NY). Chi-square test was used for analyzing categorical variables. Kolmogorov-Smirnov test was used to analyze the distribution of continuous variables, and Mann-Whitney U test or Student's t test was used for analyzing continuous variables. P< 0.005 values were considered statistically significant.

RESULTS

Forty-six patients underwent appendectomy between March-June 2020 period and included into the study as the pandemic group. One-hundred and one patients on whom appendectomy was performed in the same period in 2019 were included into the study as the control group. Patient demographics are summarized in Table 1. Sex, age, and co-morbidity status were similar among the groups. Before the lock-down, more appendectomies were performed, and the difference was significant (p< 0.05) (Table 2). Table 3 shows the differences of the parameters between the groups, and it was found that only the length of hospital stay was significantly longer in the control group statistically. There was an increasing trend for preoperative computed tomography (CT) scan and decreasing trend for preoperative ultrasonography (USG), but these changes were not statistically significant (p= 0.133 and p= 0.238, respectively). There was no 30-day mortality, and no major complications (Clavien-Dindo III-IV) occurred perioperatively (5).

Table 1. Demographic features of the groups

	After COVID-19 outbreak	Before COVID-19 outbreak	p
Age-Median (min-max, SD)	31.5 (18-66,12.34)	31 (19-89,14.43)	0.701*
Sex			
Male (%)	27 (58.7%)	61 (60.4%)	
Female (%)	19 (41.3%)	40 (39.6%)	0.845±
Total (%)	46 (100%)	101 (100%)	
Co-morbidity			
Yes (%)	13 (28.3%)	15 (14.9%)	
No (%)	33 (71.7%)	86 (85.1%)	0.055±
Total (%)	46 (100%)	101 (100%)	

Min: Minimum, Max: Maximum, SD: Standart deviation.
*Mann-Whitney U test.
±Chi-square test.

Table 2. Distribution of the patients per month

	Before COVID-19 lockdown	After COVID-19 lockdown	p*
1st month	27	17	
2nd month	28	7	
3rd month	22	11	
4th month	24	11	
Total number of cases	101	46	***<0.05***
Mean number of operations per month (SD)	25.2 (±2.75)	11.5 (±4.12)	

*Patients were divided four groups in each period and difference of mean number of operations was analyzed using Student's t test.

Table 3. Comparison of the appendectomies; before COVID-19 lockdown vs after COVID-19 lockdown

	Before COVID-19 lockdown	After COVID-19 lockdown	p
Mean length of hospital stay (Min-Max,SD)	2.15 (1-5,0.733)	1.31 (1-6,0.977)	*<0.05*
Surgery type (%)			
Open	96 (95%)	46 (100%)	0.325
Laparoscopic	5 (5%)	0 (0%)	
Total	101 (100%)	46 (100%)	
Early postoperative complications (%)			
Yes	101 (100%)	45 (97.8%)	0.313
No	0 (0%)	1 (2.2%)	
White blood cell count mean (min-max, SD)	12200.9 (5700-25300,3946.7)	13197 (5500-23700, 3764.3)	0.152*
Peri-appendicular abscess (%)			
Yes	11 (10.9%)	6 (13 %)	
No	90 (89.1%)	40 (87 %)	0.705
Total	101 (100%)	46 (100%)	
Histopathological examination (%)			
Acute appendicitis	95 (94%)	43 (94%)	
Normal histology	6 (6 %)	3 (6%)	1.00
Total	101	46 (100%)	
Preoperative radiological tools			
USG			
Yes	41 (40.5%)	14 (30.4%)	
No	60 (59.5 %)	32 (69.6 %)	0.238
CT			
Yes	79 (78.2 %)	41 (89.1 %)	
No	22 (21.8 %)	5 (10.9 %)	0.113

* Student's t test.

DISCUSSION

The COVID-19 pandemic resulted in a dramatic reduction in the number of appendectomies (104 vs 46, p< 0.05). Our results were compatible with previous publications (6-14). There three possible major reasons of those changes. First, our hospital was re-organized for COVID-19 pandemic and transformed as 'Pandemic Hospital' that resulted in limited hospital resources. Second, patients with mild symptoms might not have applied to emergency services due to fear of being infected with coronavirus, and those patients managed by family physician or self-treatment with analgesics and antibiotics. The last possible reason is that the patients might have preferred private hospitals for operation.

Although a downward trend was observed in the appendectomy procedure during COVID-19 lockdown period, we found that preoperative and postoperative parameters were similar when compared with the same period in previous year except length of hospital stay. Mean length of hospital stay was significantly higher before the COVID-19 lockdown period in our study, which was incompatible with the majority of previous reports (6,9,13,15). Although Bajomo et al. have reported higher length of hospital stay time before the lockdown period (three days vs 2.6 days), the difference was not significant (p= 0.35) (16). As a nature of being a 'social state', the healthcare system was supported by the government in our country. Majority of the citizens are free of charge from any medical services in state hospitals. Therefore, some patients wished to stay one or two more days at the hospital because of social reasons including living in a rural area, being far from healthcare centers, and having no relatives to take care of after surgery. However, during the lockdown, patients desired to be discharged as soon as possible, which explains the shorter length of hospital stay in the lockdown period.

During the lockdown period, a slight change was seen in the use of radiological tools. Radiologists wanted to be cautious of COVID-19 infection, and they avoided close contact with the patients. Although there was no significant difference, preoperative use of USG decreased and use of CT increased. Similarly, some authors have reported that use of CT imaging for acute appendicitis diagnosis increased, therefore negative appendectomy rates decreased (15-17). However, in the present study,

our negative appendectomy rates were acceptable and similar in both groups (6% vs 6%).

AA is an urgent situation, and traditionally, it is believed that surgery should not be delayed. However, some authors have suggested that it is safe to delay surgery until obtaining COVID-19 test result without any increase of complication rates (18). It could be logical but due to the limited number of test kits at the beginning of the pandemic, PCR tests were only performed in patients with COVID-19 symptoms in our institution. Now, we have enough PCR test kits, and the patients are hospitalized after obtaining negative PCR results (except critical urgent conditions including trauma, perforation etc.). At the moment, PCR positive cases are operated in isolated operation rooms and followed in isolated COVID-19 beds postoperatively.

Probably the most interesting finding of the studies on COVID-19 and AA association is the efficacy of non-operative treatment of the disease (1,6,17,19). In fact, non-operative treatment is not a novel approach, and various articles have been published about its safety and efficacy but many surgeons are still performing surgery (13). AA is caused by luminal obstruction that leads to stasis, mucosal ischemia and bacterial overgrowth (20). This pathogenesis is similar to acute cholecystitis or intestinal obstruction. In those situations, usually medical treatment is given as first-line treatment (21,22). Lotfallah et al. have reported that with a careful selection, non-operative treatment of appendicitis is safe and effective (1). Both single-center and multicenter studies indicate that non operative treatment is an alternative treatment option to surgery, and also updated guidelines recommend medical treatment of AA during the COVID-19 pandemic (14,23-25). Recent meta-analysis by Emile et al., including fourteen studies and 2140 patients, haas suggested that non-operative AA treatment should be considered in adult patients; however, in the pediatric population, physicians must be aware of treatment failure (19). In our institute, we still prefer surgical treatment for acute appendicitis because of low complication rates, short length of hospital stay, easier to follow-up postoperative patients compared with treated medically.

This study has three major limitations that should be addressed. First, this is a single center retrospective cohort study with small numbers of patients. Second, vast majority of the cases were treated by surgical intervention, and non-operative treatment group was not included to the study. Third, we only included the patients diagnosed with AA in the first wave (March 2020-June 2020) of COVID-19 in Turkey, and the effects of the second and third waves or mutant viruses on AA were unknown.

In conclusion, although the number of performed appendectomy decreased significantly during the COVID-19 pandemic, perioperative parameters were similar in both groups, and appendectomy procedure can be done safely and successfully in patients with AA .

Ethics Committee Approval: This study was approved by Samsun Research and Training Hospital Non-invasive Clinical Research Ethics Committee (Decision no: 2021/11/11, Date: 09.06.2021).

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - S.O., Ö.F.B.; Design - All of authors; Supervision - S.O.; Materials - M.S.U., Ö.F.B.; Data Collection and/or Processing - M.S.U., Ö.F.B., A.B.Ç.; Analysis and/or Interpretation - S.O., A.B.Ç.; Literature Search - All of authors; Writing Manuscript - S.O., A.B.Ç.; Critical Reviews - S.O., A.B.Ç., Ö.F.B.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

1. *Lotfallah A, Aamery A, Moussa G, Manu M. Surgical versus conservative management of acute appendicitis during the COVID-19 pandemic: A single-centre retrospective study. Cureus 2021; 13(3). https://doi.org/10.7759/cureus.14095*
2. *Tiwari MM, Reynoso JF, Tsang AW, Oleynikov D. Comparison of outcomes of laparoscopic and open appendectomy in management of uncomplicated and complicated appendicitis. Ann Surg 2011; 254(6): 927-32. https://doi.org/10.1097/SLA.0b013e31822aa8ea*
3. *Geerdink TH, Augustinus S, Atema JJ, Jensch S, Vrouenraets BC, de Castro SMM. Validation of a scoring system to distinguish uncomplicated from complicated appendicitis. J Surg Res 2021; 258: 231-8. https://doi.org/10.1016/j.jss.2020.08.050*
4. *Koca F. Promotion of scientific research on COVID-19 in Turkey. Lancet 2020; 396(10253). https://doi.org/10.1016/S0140-6736(20)31864-X*
5. *Dindo D, Demartines N, Clavien PA. Classification of surgical complications: A new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg 2004; 240(2): 205-13. https://doi.org/10.1097/01.sla.0000133083.54934.ae*
6. *Ganesh R, Lucocq J, Ekpete NO, Ain NU, Lim SK, Alwash A, et al. Management of appendicitis during COVID-19 pandemic; short-term outcomes. Scott Med J 2020; 65(4): 144-8. https://doi.org/10.1177/0036933020956316*
7. *Kelly ME, Murphy E, Bolger JC, Cahill RA. COVID-19 and the treatment of acute appendicitis in Ireland: A new era or short-term pivot? Colorectal Dis 2020; 22(6): 648-9. https://doi.org/10.1111/codi.15141*
8. *Dreifuss NH, Schlottmann F, Sadava EE, Rotholtz NA. Acute appendicitis does not quarantine: Surgical outcomes of laparoscopic appendectomy in COVID-19 times. Br J Surg 2020; 107(10): e368-e369. https://doi.org/10.1002/bjs.11806*
9. *Tankel J, Keinan A, Blich O, Koussa M, Helou B, Shay S, et al. The decreasing ıncidence of acute appendicitis during COVID-19: A retrospective multi-centre study. World J Surg 2020; 44(8): 2458-63. https://doi.org/10.1007/s00268-020-05599-8*
10. *Toale C, Westby D, O'Callaghan M, Nally D, Burke P, Peirce C, et al. Appendicitis and the COVID pandemic; new challenges in the management of a familiar foe. Br J Surg 2020; 107(12): e605-e606.*
11. *Romero J, Valencia S, Guerrero A. Acute appendicitis during coronavirus disease 2019 (COVID-19): Changes in clinical presentation and CT findings. J Am Coll Radiol 2020; 17(8): 1011-3. https://doi.org/10.1016/j.jacr.2020.06.002*

12. *Somers K, Abd Elwahab S, Raza MZ, O'Grady S, DeMarchi J, Butt A, et al. Impact of the COVID-19 pandemic on management and outcomes in acute appendicitis: Should these new practices be the norm? Surgeon 2021; 19(5): e310-e317. https://doi.org/10.1016/j.surge.2021.01.009*

13. *Willms AG, Oldhafer KJ, Conze S, Thasler WE, von Schassen C, Hauer T, et al. Appendicitis during the COVID-19 lockdown: Results of a multicenter analysis in Germany. Langenbecks Arch Surg 2021; 406(2): 367-75. https://doi.org/10.1007/s00423-021-02090-3*

14. *Ielpo B, Podda M, Pellino G, Pata F, Caruso R, Gravante G, et al. Global attitudes in the management of acute appendicitis during COVID-19 pandemic: ACIE Appy Study. Br J Surg 2020; 10.1002/bjs.11999. https://doi.org/10.1093/bjs/znab182*

15. *Ceresoli M, Coccolini F, Magnone S, Lucianetti A, Bisagni P, Armao T, et al. The decrease of non-complicated acute appendicitis and the negative appendectomy rate during pandemic. Eur J Trauma Emerg Surg 2021: 1-7. https://doi.org/10.1007/s00068-021-01731-y*

16. *Bajomo O, Hampal R, Sykes P, Miah A. Managing appendicitis during the COVID-19 era: A single centre experience & implications for future practice. Ann Med Surg (Lond) 2021; 63: 102168. https://doi.org/10.1016/j.amsu.2021.02.014*

17. *Antakia R, Xanthis A, Georgiades F, Hudson V, Ashcroft J, Rooney S, et al. Acute appendicitis management during the COVID-19 pandemic: A prospective cohort study from a large UK centre. Int J Surg 2021; 86: 32-7. https://doi.org/10.1016/j.ijsu.2020.12.009*

18. *Lee KY, Lee J, Park YY, Oh ST. Effect of the COVID-19 pandemic on surgical treatment of acute appendicitis: A single-center retrospective study. Asian J Surg 2021; 44(5): 800-1. https://doi.org/10.1016/j.asjsur.2021.03.012*

19. *Emile SH, Hamid HKS, Khan SM, Davis GN. Rate of Application and outcome of non-operative management of acute appendicitis in the setting of COVID-19: Systematic review and meta-analysis. J Gastrointest Surg 2021: 1-11. https://doi.org/10.1007/s11605-021-04988-1*

20. *Malhotra K, Bawa A. Routine histopathological evaluation after appendectomy: Is ıt necessary? a systematic review. Cureus 2020; 12(8): e9830. https://doi.org/10.7759/cureus.9830*

21. *Adachi T, Eguchi S, Muto Y. Pathophysiology and pathology of acute cholecystitis: A secondary publication of the Japanese version from 1992. J Hepatobiliary Pancreat Sci 2022; 29(2): 212-6. https://doi.org/10.1002/jhbp.912*

22. *Vilz TO, Stoffels B, Strassburg C, Schild HH, Kalff JC. Ileus in adults. Dtsch Arztebl Int 2017; 114(29-30): 508-18. https://doi.org/10.3238/arztebl.2017.0508*

23. *Patel VK, Ye K, In H, Scheinfeld MH. Non-operative management for acute appendicitis during the COVID-19 pandemic does not ıncrease the rate of complications. J Gastrointest Surg 2021; 25(5): 1327-9. https://doi.org/10.1007/s11605-020-04844-8*

24. *COVID-19 Guidelines for Triage of Emergency General Surgery Patients. Available from: https://www.facs.org/covid-19/clinical-guidance/elective-case/emergency-surgery*

25. *Moletta L, Pierobon ES, Capovilla G, Costantini M, Salvador R, Merigliano S, et al. International guidelines and recommendations for surgery during Covid-19 pandemic: A systematic review. Int J Surg 2020; 79: 180-8. https://doi.org/10.1016/j.ijsu.2020.05.061*

ORİJİNAL ÇALIŞMA-ÖZET
Turk J Surg 2022; 38 (2): 175-179

COVID-19 salgını ve akut apandisit: Karantinanın apendektomiler üzerine bir etkisi var mı? Tek merkezli retrospektif kohort calışma

Sönmez Ocak, Ömer Faruk Bük, Mustafa Safa Uyanık, Ahmet Burak Çiftci

Samsun Eğitim ve Araştırma Hastanesi, Genel Cerrahi Kliniği, Samsun, Türkiye

ÖZET

Giriş ve Amaç: COVID-19 pandemisi tüm dünyada sağlık sistemlerini olumsuz etkilemiştir. Elektif cerrahilerin ertelenmesinin yanısıra acil durumlarda dahi cerrahi tedaviye alternatif olarak konservatif tedavi seçenekleri gündeme gelmiştir. Bu çalışma ile bir pandemi hastanesinde COVID-19 pandemisinin acil apendektomi olguları üzerine etkileri araştırılması hedeflenmiştir.

Gereç ve Yöntem: Mart 2020 - Haziran 2020 tarihleri arasında apendektomi operasyonu yapılan hastalar çalışmaya dahil edilmiştir (pandemi grubu). Bu grup ile karşılaştırmak amacı ile 2019 yılının aynı döneminde apendektomi yapılan hastalar kontrol grubu olarak çalışmaya dahil edilmiştir. Hastaların demografik özellikleri, laboratuvar ve radyolojik bulguları, hastane kalış süreleri ve histopatolojik bulguları kaydedildi.

Bulgular: Pandemi grubunda 46, kontrol grubunda 101 hasta çalışmaya dahil edildi. Hastaların özellikleri her iki grupta benzer idi. Kontrol grubunda hastanede kalış süresi daha uzun olarak bulundu.

Sonuç: COVID-19 pandemisi sırasında apendektomi sayısında azalma görülmesine rağmen perioperatif parametreler her iki grupta benzerdi.

Anahtar Kelimeler: Akut apandisit, apendektomi, COVID-19, karantina, sokağa çıkma kısıtlaması

DOİ: 10.47717/turkjsurg.2022.5440