

Recommendations for trauma and emergency general surgery practice during COVID-19 pandemic

 Ali Fuat Kaan Gök, M.D.,¹  Mehmet Eryılmaz, M.D.,²  Mehmet Mahir Özmen, M.D.,³
 Orhan Alimoğlu, M.D.,⁴  Cemalettin Ertekin, M.D.,¹  Mehmet Hamdi Kurtoğlu, M.D.¹

¹Department of General Surgery, İstanbul University İstanbul Faculty of Medicine, İstanbul-Turkey

²Department of General Surgery, University of Health Sciences, Gülhane Training and Research Hospital, Ankara-Turkey

³Department of General Surgery, İstinye University Faculty of Medicine, İstanbul-Turkey

⁴Department of General Surgery, İstanbul Medeniyet University Faculty of Medicine, İstanbul-Turkey

ABSTRACT

COVID-19 is a new disease, based on currently available limited information, older adults and people of any age who have severe underlying medical conditions may be at higher risk for severe illness from COVID-19. People of all age groups are also at risk. Healthcare providers have always been the professionals most exposed to the risk of contracting to any kind of infection due to the nature of their profession. Elective interventions have been postponed to give care of patients with COVID-19. However, some interventions cannot be delayed, such as trauma surgery, acute abdomen, and emergency endoscopies. To maintain the sustainability of the healthcare system, the protection of healthcare providers should be the top priority. On the other hand, patients, who need emergency healthcare, should also be provided with appropriate treatment. Healthcare professionals should choose a treatment method appropriately in the circumstances to protect themselves and their patients as much as possible. This paper aims to summarize how a surgeon may act appropriately when an intervention is inevitable during the COVID-19 pandemic.

Keywords: Coronavirus; COVID-19; emergency surgery; endoscopy; trauma.

INTRODUCTION

Many people say that we, all the world, are at war against an insidious and invisible enemy. Health-care providers have always been the professionals most exposed to the risk of contracting to any kind of infection due to the nature of their profession. For the sustainability of health-care during the Coronavirus Disease 2019 (COVID-19) Pandemic, these valuable and necessary people, who fight in the front line, should be protected from the infection as possible as it can. Elective interventions have been postponed to provide care for patients with COVID-19. However, some interventions cannot be delayed, such as trauma surgery, acute abdomen, and emergency endoscopies. This paper aims to summarize how a surgeon may act appropriately when an intervention is inevitable even if he or she has a patient with confirmed, suspected, or not COVID-19.

BACKGROUND

COVID-19 is an infectious disease that arises from severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). At the beginning of December 2019, several cases of pneumonia of unknown etiology have been reported in Wuhan, Hubei province.^[1,2] On 7 January 2020, a novel coronavirus was identified by the Chinese Center for Disease Control and Prevention from the throat swab sample of a patient and was subsequently named 2019-nCoV by World Health Organization. Since then, the virus has spread worldwide, which leads to the ongoing coronavirus pandemic in 2019–20. The World Health Organization (WHO) declared the 2019–20 coronavirus outbreak a pandemic on 11 March 2020.^[3,4]

COVID-19 is a new disease, based on currently available limited information, older adults and people of any age who have

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Address for correspondence: Ali Fuat Kaan Gök, M.D.

İstanbul Üniversitesi İstanbul Tıp Fakültesi, Genel Cerrahi Anabilim Dalı, 34093 İstanbul, Turkey

Tel: +90 212 - 414 20 00 E-mail: afkgok@gmail.com



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severe underlying medical conditions may be at higher risk for severe illness from COVID-19.^[5,6] People of all age groups are also at risk. A recent review and meta-analysis showed that the most common symptoms in patients with SARS-CoV-19 infection were fever, cough, muscle aches, and/or fatigue, and dyspnea.^[7] In COVID-19, real-time reverse transcription-polymerase chain reaction (RT-PCR) of viral nucleic acid is regarded as the reference standard to confirm the diagnosis.^[8] Lymphocytopenia and elevated alanine aminotransferase, D-Dimer, serum ferritin, creatine kinase, and disease severity were reported to be associated with intensive care unit admission. Older age, elevated d-dimer levels, and high SOFA score could indicate that patients with COVID-19 who have a poor prognosis.^[6] Direct chest X-Rays may be normal in early or mild disease. The most common chest X-Ray abnormalities reported were bilateral opacities, multiple ground-glass shadows, infiltrate shadows and consolidation in the lungs, and thickening of the pulmonary texture. Some chest computed tomographic (CT) findings may be characteristic of COVID-19. The most frequent CT abnormalities were ground-glass opacities, septal thickening, and parenchymal consolidation. CT abnormalities are more likely to be bilateral, have a peripheral distribution, and involve the lower lobes.^[7,9,10] The same review mentioned before showed that mortality among the patients infected with SARS-CoV-19 was 3.0%, and most of the data were from China. In epidemiological studies from China, male sex, age ≥ 60 years, delay in diagnosis, and diagnosis of severe pneumonia were associated with increased mortality rates.^[7]

RECOMMENDATIONS

Since the announcement of the first cases of COVID-19 centers, as in all the health-care systems, have been trying to be adapting the new situation, and various preliminary guidelines have been published.^[11-16] In this section, evidence-based recommendations are presented based on current data. The summary of recommendations can be seen in Table 1.

A. Organization

I. A triage center should be established.

Hospitals should reorganize to identify and isolate patients with COVID-19 symptoms at the first point of contact with the health care system. Patients should be triaged according to the testing algorithm of the facility, and initial testing should optimally be performed in a manner separated from the general patient population. All patients, including minor trauma patients, must undergo triage first and then transferred to if they have no suspicion of COVID-19. If there is suspicion, they should be admitted to a dedicated area. Health care should be given to these patients by specially prepared staff and observed or operated in a dedicated area. Thus, staff and patients without COVID-19 can be protected from contracting the virus. Hemodynamically unsta-

Table 1. Summary of the recommendations

A. Organization (refer to section A)

- Establish a triage center
- Triage all patients except hemodynamically unstable
- Set up a designated area for providing care to a patient with suspected or confirmed COVID-19
- Restructure the team for minimizing the number of staff
- Restrict clinic visits of the students and non-essential personnel

B. Admission (refer to section B)

- Have all patients wear masks
- Use PPE
- Ask COVID-19 symptoms, travel and exposure history
- Measure body temperature
- Take the nasopharyngeal swab for suspected cases
- Consider additional tests according to current guidelines and availability
- Do not delay patient evaluation, especially for trauma patients
- Add a chest CT into routine tests
- Consider nonoperative management if appropriate

C. Operating room (refer to section C)

- Establish a dedicated OR for patients with suspected or confirmed COVID-19
- Take appropriate precautions and use PPE for droplet contact
- Treat all patients as presumed COVID-19 positive if they have symptoms/exposure history
- Restrict non-essential staff and keep additional personnel out of OR
- Do not take personal items to OR
- Keep only necessary materials for the surgery within OR
- Wear and discard all disposable protective equipment after each case
- Use an aspirator to reduce the smoke exposure
- Use filter devices for laparoscopic procedures
- Choose an appropriate approach to minimize OR time and maximize staff safety

D. Endoscopy (refer to section D)

- Do urgent endoscopic procedures only (stop bleeding, stenting for obstruction)
- Take appropriate precautions and use PPE for droplet contact
- Consider an alternative method to replace endoscopic procedure if possible

OR: Operating room; PPE: Personal protective equipment

ble trauma patients or major multiple trauma patients should immediately admit to ACS without undergoing triage. Establishing a triage center, such as in a tented environment or designated area within a facility, could help to make possible that policy.^[13,17]

2. The number of personnel should be minimized at the shift and bedside to protect health-care providers from the cumulative viral burden.

Serious challenges in responding to COVID-19 are protecting health-care providers and preventing nosocomial infection, which have been significant problems in China and Italy that worst-affected country of Europe.^[18] Restructuring teams and minimizing the number of providers are crucial policies to reduce the number of trauma/emergency surgery providers in the hospital simultaneously. Thus, exposure risk could be decreased and preserve staff.^[13] Rounds should be done with as few staff as possible. Routine training sessions for residents and clinical meetings such as core lectures, mortality and morbidity meetings can be held by teleconferences. Clinic visits of non-essential personnel and students should be restricted for their own protection and personal protective equipment (PPE) saving.^[19]

B. Admission

1. A face mask must be placed on the patient, even if the patient has no upper respiratory symptoms.

According to a Chinese study, among of 262 patients, 46 (17.6%) were severe cases, 216 (82.4%) were common cases, which including 192 (73.3%) mild cases, 11 (4.2%) non-pneumonia cases and 13 (5.0%) asymptomatic cases, respectively.^[20] Also, Mizumoto et al.^[21] showed that the estimated asymptomatic proportion was 17.9% (95% credible interval (CrI): 15.5–20.2%) within the population onboard a cruise ship called the Diamond Princess. However, in an open letter to the authorities in the Tuscany region, Romagnani wrote that the vast majority of people infected with COVID-19, 50–75% were asymptomatic, but represented “a formidable source” of contagion.^[22] The data show that between 5% and 80% of people testing positive for Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) may be asymptomatic. According to data, all patients must wear a face mask; relatives of patients entered the emergency department should be limited. If a companion needed, he or she must wear a mask as well. It is essential to reduce unwitting transmission of the virus from asymptomatic carriers.

2. Health-care providers should take appropriate precautions and use personal protective equipment for droplet contact.

Due to the high contagiousness and rapid spread of SARS-CoV-2, a significant proportion of cases are related to occupational exposure. As cases increased and considering the increasing number of admissions to the emergency departments, health-care providers should be considered as a high-risk group to acquire this infection. In a case series of 138 patients treated in a Wuhan hospital, 40 patients (29% of cases) were hospital staff. Among the affected personnel, 31 (77.5%) worked on general wards, seven (17.5%) in the emergency department, and two (5%) in the intensive care unit.^[23] In Turkey, there are 601 health-care providers infected with SARS-CoV-2 so far.^[24] Especially in trauma settings, due to

the urgency of the incident, health-care providers must not act recklessly. All teams must prepare, take appropriate precautions, and use PPE for droplet contact to protect themselves.

3. Patients should be questioned for COVID-19 symptoms, fever, cough or sneeze, exposure, and travel history, but the patient evaluation must not be delayed to assess COVID-19 status, especially for trauma patients.

Frequently reported symptoms of patients with COVID-19 are fever, cough, myalgia or fatigue, shortness of breath, and gastrointestinal symptoms, such as diarrhea and nausea.^[23,25,26] Patients must be carefully questioned for these symptoms, exposure, and travel history due to the high contagiousness of SARS-CoV-2. The body temperature of all patients should be measured and recorded. Especially in unconscious trauma patients, the presence of fever should be considered concerning COVID-19, if it cannot be explained due to trauma. It should be kept in mind that delays in diagnosis and treatment increase complications in trauma patients.^[27,28]

4. Appropriate laboratory tests for COVID 19 should be chosen

The presence of SARS-CoV-2 virus and antibodies produced in response to infection can be detected with several methods. In COVID-19 diagnosis, RT-PCR of viral nucleic acid is regarded as the reference standard. The RT-PCR test performed with nasopharyngeal and throat swabs is only reliable in the first week of the disease. Some studies reported that potentially high false-negative rate of real-time reverse-transcriptase RT-PCR testing for SARS-CoV-2 and patients experienced a “turn positive” of nucleic acid detection by RT-PCR test for SARS-CoV-2 after two consecutive negative results.^[19,30] For suspected cases, the nasopharyngeal swab should be taken, but waiting for the test results should not delay treatment. Serology tests for detecting the antibody can also be useful for COVID-19 diagnosis if available. IgM antibodies to SARS-CoV-2 are generally detectable in the blood several days after the initial infection.^[31] There is no evidence to indicate that trauma patients are at higher risk than the general population and, as such, should be screen according to institutional and national policy for asymptomatic patients.^[32] In COVID-19, lymphocytopenia, elevated alanine aminotransferase, lactate dehydrogenase, D-Dimer, serum ferritin, creatine kinase are associated with poor prognosis as mentioned before. Some of these tests, such as D-Dimer and creatine kinase, could be abnormal in emergent conditions, especially for trauma patients with extensive soft tissue injuries. However, they may be good negative predictors.^[33,34]

5. A chest CT scan should be added into routine diagnostic tools to detect COVID-19 pneumonia, even if the patient has no symptoms.

Recent studies addressed the importance of chest CT exam-

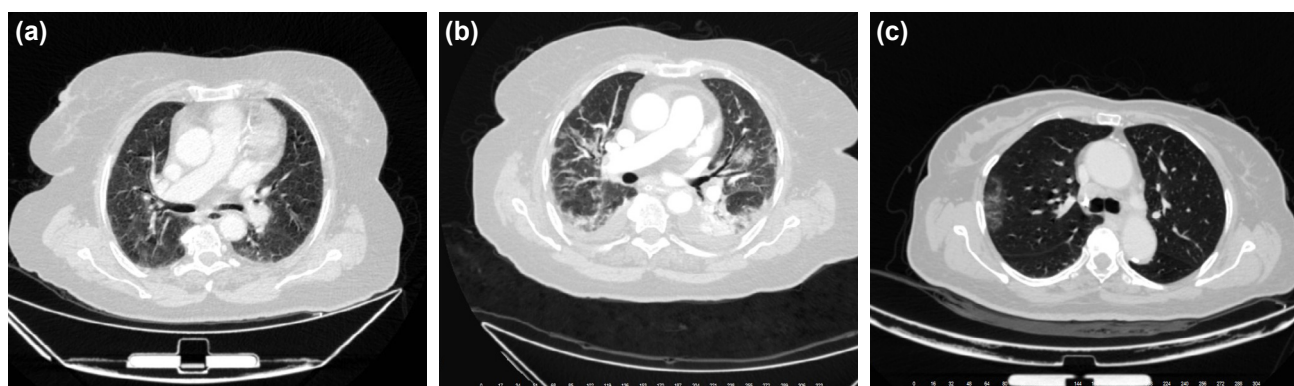


Figure 1. (a) Admission chest CT of a mesenteric ischemia case. There was no significant abnormality. (b) Chest CT of the same patient, seven days after index operation. The second chest CT showed that there were ground-glass opacities, septal thickening, and parenchymal consolidation bilaterally. (c) Chest CT of a patient with cholangitis and asymptomatic COVID-19 who was planned to undergo ERCP. CT showed that there was ground-glass opacity at the right lung. The patient underwent percutaneous transhepatic biliary drainage.

ination in COVID-19 patients with false negative-PCR results and reported the CT sensitivity as 98%.^[35] The hallmarks of COVID-19 infection on imaging are bilateral and peripheral ground-glass and consolidative pulmonary opacities, sometimes with a rounded morphology and peripheral lung distribution.^[36] However, intensification of a crazy-paving pattern, an increase in the number of involved lobes, and the appearance of consolidative opacities occurred in most patients over time. On average, CT findings were most prominent on day 10 of the disease. After day 14, improvement in imaging findings was reported in 75% of the patients, including decreased number of involved lobes and resolution of crazy paving pattern and consolidative opacities.^[37] A recent study showed that 54% of the asymptomatic patients had pneumonic changes on chest CT,^[38] but it should be kept in mind that 56% of the patients in the early period of the disease may have a normal CT.^[39] If the patient develops symptoms and

the symptoms cannot be explained due to the clinical status of the patient, a new evaluation should be required (Figs. 1a-b, 2). It should also be noted that it may take 4–120 hours to obtain PCR results; this is not suitable for acute care patients. Due to its wide availability and fast examination time, the supplemental role of chest CT to RT-PCR is growing for early detection of patients with COVID-19 pneumonia.

6. Non-operative management should be considered whenever it is clinically appropriate for the patient.

Uncomplicated acute appendicitis may be treated with intravenous antibiotics, then transition to peroral antibiotics. In selected cases, the nonsurgical treatment group shows a relapse rate of approximately 14% in one year.^[40] Also, high failure rates of conservative approach (30–50%) have been noted with appendicolith and with CT evidence of disease extension outside of the right lower quadrant.^[41,42] Conservative

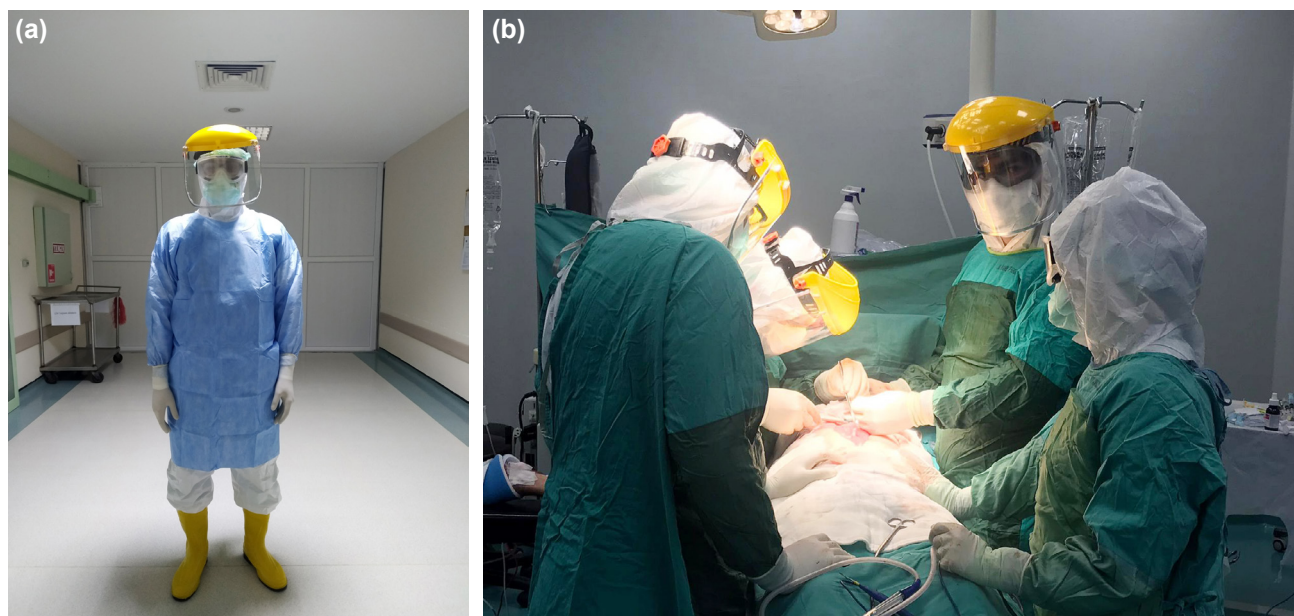


Figure 2. (a) A surgeon who wore enhanced droplet/airborne PPE. (b) The ACS team who wore enhanced droplet/airborne PPE in operation for a patient with suspected COVID-19.

treatment of complicated appendicitis may require radiologic-guided drainage of a peri-appendiceal abscess with intravenous antibiotics. However, no consensus exists among surgeons regarding the optimal treatment for patients with complicated appendicitis.^[43] Surgical treatment should be considered for patients with complicated appendicitis or COVID-19 negative patients with uncomplicated appendicitis.

Acute calculous cholecystitis can be treated with appropriate antimicrobial agents. Percutaneous cholecystostomy is a potential alternative to cholecystectomy. Percutaneous cholecystostomy should be used if antibiotic treatment fails.^[44]

Cholecystectomy can be postponed for patients with mild to moderate gallstone pancreatitis, but the possibility of recurrence should be considered.^[45] Symptomatic patient with infected pancreatic necrosis usually requires intervention, although a small number of patients have been shown to recover with antibiotics only.^[46] If the patient deteriorates, a step-up approach starting with percutaneous or endoscopic drainage is indicated, but the risks of the endoscopic approach mentioned below should be noted.^[47] To avoid the risks of endoscopy, a single-stage open necrosectomy should be considered.

Patients with Hinchey 4 complicated diverticulitis should undergo surgery. Patients with Hinchey 3 and 2 can be treated with intravenous antibiotics and radiologic-guided abscess drainage. CT-proven uncomplicated (Hinchey 1a and 1b) diverticulitis patients can be treated outpatient with peroral antibiotics. Also, patients with isolated pericolic extraluminal air can be treated conservatively as well.^[44]

Non-operative management of hemodynamically stable trauma patients with solid organ injury is appropriate for selected patients. However, abnormal clotting, apparently resulting from endothelial damage, has been described in patients with severe COVID-19 disease, and initiating prompt anticoagulation therapy, is recommended in all severe COVID-19 patients.^[6,48] Initiating anticoagulation therapy may lead to non-operative management to fail. In these patients, mechanical venous thromboembolism prophylaxis should be applied and observed closely. High D-dimer levels seen in these patients point to abnormal coagulation throughout the body. The development of thrombosis is thought to be due to endothelial damage that arises from the virus, so the mechanical prophylaxis may not be able to prevent thrombosis. Interventional radiologic techniques, such as embolization of a pseudoaneurysm, percutaneous drainage of a biloma, intra-abdominal blood, or abscess hemorrhage could apply safely with proper precautions taken. If needed, an aerosol-generating procedure such as bag masking, intubation, bronchoscopy, and chest tube application, should only be performed wearing enhanced PPE.

For a patient with COVID-19 for whom surgery is manda-

tory, such as hemodynamically unstable trauma patients or ruptured abdominal aortic aneurysm, hollow viscus perforation, intestinal ischemia, and intestinal obstruction, an appropriate surgical approach, should wisely be chosen and applied as mentioned below.

7. Operating Room

A dedicated operating room (OR) should be available for confirmed or suspected COVID-19 patients. All patients must be treated as presumed COVID-19 positive if they have symptoms/exposure history that warrants testing or are unable to provide information such as unconscious trauma patients. A recent study showed that SARS-CoV-2 could remain viable in aerosols throughout the duration of the experiment (3 hours), and SARS-CoV-2 is more stable on plastic and stainless steel than on copper and cardboard. The viable virus can be detected up to 72 hours after application to these surfaces.^[49] Thus, the number of OR staff should be minimized, and all additional personnel must be out of OR. Due to the high contagiousness and viable nature of SARS-CoV-2, no unnecessary items should be brought into the operating theater; this includes personal items, such as cell phones. Disposable caps and shoe covers should be worn and discarded after each case. Only the materials necessary for the case should be within the room, and all disposables should be discarded at the end of the case. Electrocautery of blood, gastrointestinal tissue, and any of the body fluids may generate an aerosol. An aspirator should remove smoke during surgery.

All patient interactions will be performed with enhanced droplet precautions. For emergency operation on COVID-19 positive patients should be treated these as aerosol-generating procedures throughout the operative period (including intubation). Such cases should be performed with airborne precautions (N95 with face shield) and preferably in a negative pressure room.^[11,16,50,51] All staff in the OR must use N95 or FFP2/FFP3 respirator, face mask (OR face shields/masks worn over N95), gown, gloves, hair cover, and shoe covers or plastic boots (Fig. 3a, b). If there is no suspicion of COVID-19, gowns may not be necessary for PPE saving, but droplet precautions must be taken. Patients who are asymptomatic, but contagious should be kept in mind.

There is very little evidence regarding the relative risks of laparoscopy versus the conventional open approach, specific to COVID-19.^[52] Although previous research has shown that laparoscopy may lead to aerosolization of blood-borne viruses, there is no evidence to indicate that this effect is seen with COVID-19.^[53,54] The use of devices to filter released CO₂ for aerosolized particles is strongly recommended for laparoscopic procedures.^[55] An appropriate surgical approach should be chosen to minimize the duration of surgery and maximize safety for both patients and health-care staff.

8. Endoscopy

Urgent/emergent endoscopic procedures cannot be delayed. Upper and lower gastrointestinal bleeding or suspected bleeding leading to symptoms, dysphagia significantly impacting oral intake, cholangitis, or impending cholangitis that arises from common bile duct stone or periampullary tumor, palliation of upper or lower gastrointestinal obstruction are the most common emergent indications for endoscopy. Since patients can present with gastrointestinal manifestations of COVID-19, all endoscopic procedures performed in the current environment should be considered as high risk. For the patients with COVID-19, if there is an alternative method to replace endoscopy, such as transhepatic drainage of the biliary tract, it must be considered to avoid this high risk. The virus has been found in multiple cells in the gastrointestinal tract, and all fluids, including saliva, enteric contents, stool, and blood, use of surgical energy devices should be minimized.^[55] For patients who are or may be infected, endoscopy should only be performed while wearing full PPE in a designated endoscopy room. Endoscopy procedures need short physical distance from patients to endoscopy staff. Based on studies performed during the SARS outbreak of 2003, droplets from infected patients could reach persons located 2 meters or more from the source.^[19] All endoscopic interventions should only be performed in a way to resolve the urgent problem and completed as soon as possible to reduce the exposure risk and possible viral burden.

CONCLUSION

Since the announcement of the first cases of COVID-19, the health care system, as in all areas of life, has also been trying to be adapting. To maintain the sustainability of the health-care system, the protection of health-care providers should be the top priority. On the other hand, appropriate treatment should also be provided to patients requiring emergency health-care. To be able to do all this, hospitals should reorganize themselves, provide decent protective equipment to all staff, use the workforce effectively. Health-care professionals should also choose a treatment method appropriately in the circumstances to protect themselves and their patients as much as possible. In this paper, we try to summarize how these goals can be achieved for emergency surgery patients. As time goes on, we believe that our eyes will get used to the darkness that surrounds us, the research will illuminate our path, and the uncertainties about this insidious and invisible enemy will decrease. Until then, what needs to be done is to keep both health-care providers and their patients safe.

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REFERENCES

- Lu H, Stratton CW, Tang YW. Outbreak of pneumonia of unknown etiology in Wuhan, China: The mystery and the miracle. *J Med Virol* 2020;92:401–2. [CrossRef]
- Phelan AL, Katz R, Gostin LO. The Novel Coronavirus Originating in Wuhan, China: Challenges for Global Health Governance. *JAMA*. 2020 Jan 30. doi: 10.1001/jama.2020.1097. [Epub ahead of print] [CrossRef]
- Hui DS, I Azhar E, Madani TA, Ntoumi F, Kock R, Dar O, et al. The continuing 2019-nCoV epidemic threat of novel coronaviruses to global health - The latest 2019 novel coronavirus outbreak in Wuhan, China. *Int J Infect Dis* 2020;91:264–6. [CrossRef]
- WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. Available from: <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>. Accessed April 12, 2020.
- Wu Z, McGoogan JM. Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention. *JAMA* 2020;323:1239–42. [CrossRef]
- Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet* 2020;395:1054–62. [CrossRef]
- Borges do Nascimento IJ, Cacic N, Abdulazeem HM, von Groote TC, Jayarajah U, Weerasekera I, et al. Novel Coronavirus Infection (COVID-19) in Humans: A Scoping Review and Meta-Analysis. *J Clin Med* 2020;9:E941. [CrossRef]
- Corman VM, Landt O, Kaiser M, Molenkamp R, Meijer A, Chu DK, et al. Detection of 2019 novel coronavirus (2019-nCoV) by real-time RT-PCR. *Euro Surveill* 2020;25:2000045. [CrossRef]
- Zhao W, Zhong Z, Xie X, Yu Q, Liu J. Relation Between Chest CT Findings and Clinical Conditions of Coronavirus Disease (COVID-19) Pneumonia: A Multicenter Study. *AJR Am J Roentgenol*. 2020 Mar 3. doi: 10.2214/AJR.20.22976. [Epub ahead of print] [CrossRef]
- Shi H, Han X, Jiang N, Cao Y, Alwalid O, Gu J, et al. Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. *Lancet Infect Dis* 2020;20:425–34. [CrossRef]
- Karaca AS, Özmen MM, Uçar AD, Yastı AÇ, Demirer S. General Surgery Operating Room Practice in Patients with COVID-19. *Turkish J Surg* 2020;36:1–5. [CrossRef]
- Maintaining Trauma Center Access and Care during the COVID-19 Pandemic: Guidance Document for Trauma Medical Directors. Available from: <https://www.facs.org/quality-programs/trauma/maintaining-access>. Accessed April 4, 2020.
- U.S Department of Defense (DoD). COVID-19 Practice Management Guide V10. Available from: <https://health.mil/Reference-Center/Technical-Documents/2020/03/24/DoD-COVID-19-Practice-Management-Guide>. Accessed April 16, 2020.
- American College of Surgeons (ACS). COVID-19 Guidelines for Triage of Emergency General Surgery Patients. Available from: <https://www.facs.org/covid-19/clinical-guidance/elective-case/emergency-surgery>. Accessed April 16, 2020.
- Robert Fojut. How trauma programs prepared for COVID-19. 2020. Available from: <https://www.trauma-news.com/2020/04/how-trauma>

- programs-prepared-for-covid-19/. Accessed April 15, 2020.
16. Kamer E, Çolak T. What to Do When A Patient Infected With COVID-19 Needs An Operation: A Pre-surgery, Peri-surgery and Post-surgery Guide. *Turk J Colorectal Dis* 2020;30:1–8. [CrossRef]
 17. Christian MD, Sprung CL, King MA, Dichter JR, Kisson N, Devereaux AV, et al. Triage: care of the critically ill and injured during pandemics and disasters: CHEST consensus statement. *Chest* 2014;146:e61S–74S.
 18. The Lancet. COVID-19: protecting health-care workers. *Lancet* 2020;395:922. [CrossRef]
 19. Wong TW, Lee CK, Tam W, Lau JT, Yu TS, Lui SF, et al. Cluster of SARS among medical students exposed to single patient, Hong Kong. *Emerg Infect Dis* 2004;10:269–76. [CrossRef]
 20. Tian S, Hu N, Lou J, Chen K, Kang X, Xiang Z, et al. Characteristics of COVID-19 infection in Beijing. *J Infect* 2020;80:401–6. [CrossRef]
 21. Mizumoto K, Kagaya K, Zarebski A, Chowell G. Estimating the asymptomatic proportion of coronavirus disease 2019 (COVID-19) cases on board the Diamond Princess cruise ship, Yokohama, Japan, 2020. *Euro Surveill* 2020;25:2000180. [CrossRef]
 22. Day M. Covid-19: identifying and isolating asymptomatic people helped eliminate virus in Italian village. *BMJ* 2020;368:m1165. [CrossRef]
 23. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA* 2020 Feb 7. doi: 10.1001/jama.2020.1585. [Epub ahead of print] [CrossRef]
 24. Aliyev J, Sevencan S. Turkey: Death toll from coronavirus rises to 277. Available from: <https://www.aa.com.tr/en/health/turkey-death-toll-from-coronavirus-rises-to-277/1788522>. Accessed April 12, 2020.
 25. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020;395:497–506. [CrossRef]
 26. Pan L, Mu M, Yang P, Sun Y, Wang R, Yan J, et al. Clinical Characteristics of COVID-19 Patients With Digestive Symptoms in Hubei, China: A Descriptive, Cross-Sectional, Multicenter Study. *Am J Gastroenterol*. 2020 Apr 14. doi: 10.14309/ajg.0000000000000620. [Epub ahead of print] [CrossRef]
 27. Vogel JA, Liao MM, Hopkins E, Seleno N, Byyny RL, Moore EE, et al. Prediction of postinjury multiple-organ failure in the emergency department: development of the Denver Emergency Department Trauma Organ Failure score. *J Trauma Acute Care Surg* 2014;76:140–5. [CrossRef]
 28. Vles WJ, Veen EJ, Roukema JA, Meeuwis JD, Leenen LP. Consequences of delayed diagnoses in trauma patients: a prospective study. *J Am Coll Surg* 2003;197:596–602. [CrossRef]
 29. Li Y, Yao L, Li J, Chen L, Song Y, Cai Z, et al. Stability issues of RT-PCR testing of SARS-CoV-2 for hospitalized patients clinically diagnosed with COVID-19. *J Med Virol* 2020. [CrossRef]
 30. Xiao AT, Tong YX, Zhang S. False-negative of RT-PCR and prolonged nucleic acid conversion in COVID-19: Rather than recurrence. *J Med Virol*. 2020 Apr 9. doi: 10.1002/jmv.25855. [Epub ahead of print]
 31. Zhao J, Yuan Q, Wang H, Liu W, Liao X, Su Y, et al. Antibody responses to SARS-CoV-2 in patients of novel coronavirus disease 2019. *Clin Infect Dis* 2020:ciaa344. [CrossRef]
 32. The Republic of Turkey, Ministry of Health, Coronavirus Scientific Committee. COVID-19 (SARS-CoV-2 Enfeksiyonu) Rehberi. Available from: https://covid19bilgi.saglik.gov.tr/depo/rehberler/COVID-19_Rehberi.pdf. Accessed Apr 16, 2020.
 33. Johna S, Cemaj S, O'Callaghan T, Catalano R. Effect of tissue injury on D-Dimer levels: a prospective study in trauma patients. *Med Sci Monit* 2002;8:CR5–8.
 34. Zhang LD, Liu HB, Li YN, Ma HM, Liu YB, Wang MY. Correlation analysis between plasma D-dimer levels and orthopedic trauma severity. *Chin Med J (Engl)* 2012;125:3133–6.
 35. Ye Z, Zhang Y, Wang Y, Huang Z, Song B. Chest CT manifestations of new coronavirus disease 2019 (COVID-19): a pictorial review. *Eur Radiol*. 2020. doi: 10.1007/s00330-020-06801-0. [Epub ahead of print]
 36. Chung M, Bernheim A, Mei X, Zhang N, Huang M, Zeng X, et al. CT Imaging Features of 2019 Novel Coronavirus (2019-nCoV). *Radiology* 2020;295:202–7. [CrossRef]
 37. Pan F, Ye T, Sun P, Gui S, Liang B, Li L, et al. Time Course of Lung Changes On Chest CT During Recovery From 2019 Novel Coronavirus (COVID-19) Pneumonia. *Radiology* 2020:200370. [CrossRef]
 38. Inui S, Fujikawa A, Jitsu M, Kunishima N, Watanabe S, Suzuki Y, et al. Chest CT Findings in Cases from the Cruise Ship “Diamond Princess” with Coronavirus Disease 2019 (COVID-19). *Radiol Cardiothorac Imaging* 2020;2:e200110. [CrossRef]
 39. Bernheim A, Mei X, Huang M, Yang Y, Fayad ZA, Zhang N, et al. Chest CT Findings in Coronavirus Disease-19 (COVID-19): Relationship to Duration of Infection. *Radiology* 2020:200463. [CrossRef]
 40. Coccolini F, Fugazzola P, Sartelli M, Cicuttin E, Sibilla MG, Leandro G, et al. Conservative treatment of acute appendicitis. *Acta Biomed* 2018;89:119–34.
 41. Podda M, Cillara N, Di Saverio S, Lai A, Feroci F, Luridiana G, et al; ACOI (Italian Society of Hospital Surgeons) Study Group on Acute Appendicitis. Antibiotics-first strategy for uncomplicated acute appendicitis in adults is associated with increased rates of peritonitis at surgery. A systematic review with meta-analysis of randomized controlled trials comparing appendectomy and non-operative management with antibiotics. *Surgeon* 2017;15:303–14. [CrossRef]
 42. Mahida JB, Lodwick DL, Nacion KM, Sulkowski JP, Leonhart KL, Cooper JN, et al. High failure rate of nonoperative management of acute appendicitis with an appendicolith in children. *J Pediatr Surg* 2016;51:908–11. [CrossRef]
 43. Brown CV, Abrishami M, Muller M, Velmahos GC. Appendiceal abscess: immediate operation or percutaneous drainage? *Am Surg* 2003;69:829–32.
 44. Bakkaloglu H, Yanar H, Guloglu R, Taviloglu K, Tunca F, Aksoy M, et al. Ultrasound guided percutaneous cholecystostomy in high-risk patients for surgical intervention. *World J Gastroenterol* 2006;12:7179–82.
 45. Cameron DR, Goodman AJ. Delayed cholecystectomy for gallstone pancreatitis: re-admissions and outcomes. *Ann R Coll Surg Engl* 2004;86:358–62. [CrossRef]
 46. van Santvoort HC, Bakker OJ, Bollen TL, Besselink MG, Ahmed Ali U, Schrijver AM, et al. A conservative and minimally invasive approach to necrotizing pancreatitis improves outcome. *Gastroenterology* 2011;141:1254–63. [CrossRef]
 47. Leppäniemi A, Tolonen M, Tarasconi A, Segovia-Lohse H, Gamberini E, Kirkpatrick AW, et al. 2019 WSES guidelines for the management of severe acute pancreatitis. *World J Emerg Surg* 2019;14:27. [CrossRef]
 48. Tang N, Li D, Wang X, Sun Z. Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia. *J Thromb Haemost*. 2020;18:844–7. [CrossRef]
 49. van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *N Engl J Med* 2020;382:1564–67.
 50. Ti LK, Ang LS, Foong TW, Ng BSW. What we do when a COVID-19 patient needs an operation: operating room preparation and guidance. *Can J Anaesth* 2020:1–3. [CrossRef]
 51. Wax RS, Christian MD. Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients.

- Can J Anaesth 2020;1-9. [CrossRef]
52. Zheng MH, Boni L, Fingerhut A. Minimally Invasive Surgery and the Novel Coronavirus Outbreak: Lessons Learned in China and Italy. Ann Surg. 2020 Mar 26. doi: 10.1097/SLA.0000000000003924. [Epub ahead of print] [CrossRef]
53. Kwak HD, Kim SH, Seo YS, Song KJ. Detecting hepatitis B virus in surgical smoke emitted during laparoscopic surgery. Occup Environ Med 2016;73:857-63. [CrossRef]
54. Choi SH, Kwon TG, Chung SK, Kim TH. Surgical smoke may be a biohazard to surgeons performing laparoscopic surgery. Surg Endosc 2014;28:2374-80. [CrossRef]
55. Pryor A. SAGES and EAES Recommendations Regarding Surgical Response to COVID-19 Crisis. Available from: <https://www.sages.org/recommendations-surgical-response-covid-19/>. Accessed 13 Apr, 2020.

DERLEME - ÖZET

COVID-19 pandemisi sırasında travma ve acil cerrahi uygulamaları için öneriler

**Dr. Ali Fuat Kaan Gök,¹ Dr. Mehmet Eryılmaz,² Dr. Mehmet Mahir Özmen,³
Dr. Orhan Alimoğlu,⁴ Dr. Cemalettin Ertekin,¹ Dr. Mehmet Hamdi Kurtoğlu¹**

¹İstanbul Üniversitesi İstanbul Tıp Fakültesi, Genel Cerrahi Anabilim Dalı, İstanbul

²Sağlık Bilimleri Üniversitesi, Gülhane Eğitim ve Araştırma Hastanesi, Genel Cerrahi Kliniği, Ankara

³İstinye Üniversitesi Tıp Fakültesi, Genel Cerrahi Anabilim Dalı, İstanbul

⁴İstanbul Medeniyet Üniversitesi Tıp Fakültesi, Genel Cerrahi Anabilim Dalı, İstanbul

COVID-19, mevcut olan sınırlı bilgilere göre, yaşlılar ve yandaş hastalıkları olan her yaşta insan için ciddi problemler yaratabilecek yeni bir hastalıktır. Ayrıca, tüm yaş grupları da risk altındadır. Sağlık çalışanları, mesleklerinin doğası gereği her türlü enfeksiyona yakalanma riskine en çok maruz kalan profesyoneller olmuştur. Elektif cerrahiler COVID-19 hastalarına bakım vermek için ertelenmiştir. Bununla birlikte, travma cerrahisi, akut karın ve acil endoskopiler gibi bazı müdahaleler geciktirilemez. Sağlık sisteminin sürdürülebilirliğini korumak için sağlık çalışanlarının korunması en önemli konulardan birisidir. Öte yandan, acil sağlık hizmeti gerektiren hastalara da uygun tedavi sağlanmalıdır. Sağlık çalışanları, kendilerini ve hastalarını mümkün olduğunca koruyarak, en uygun tedavi yöntemini seçmelidir. Bu çalışma, COVID-19 pandemisi sırasında, bir cerrahin yapması gereken müdahale kaçınılmaz olduğunda nasıl uygun davranabileceğini özetlemeyi amaçlamaktadır.

Anahtar sözcükler: Acil cerrahi; COVID-19; endoskopi; koronavirüs; travma.

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