


Resuming elective surgical services in times of COVID-19 infection

Raul Coimbra ^{1,2,3} Sara Edwards,^{1,4} Bruno Cammarota Coimbra,^{3,5} Arnold Tabuenca^{4,6}

¹Department of Surgery, Riverside University Health System, Moreno Valley, California, USA

²School of Medicine, Loma Linda University, Loma Linda, California, USA

³CECORC—Comparative Effectiveness and Clinical Outcomes Research Center, Riverside University Health System, Moreno Valley, California, USA

⁴Surgery, University of California Riverside School of Medicine, Riverside, California, USA

⁵University of California Santa Barbara, Santa Barbara, California, USA

⁶Surgery—Administration, Riverside University Health System, Moreno Valley, California, USA

Correspondence to

Dr Raul Coimbra;
raulcoimbra62@yahoo.com

Received 11 May 2020

Accepted 11 May 2020

© Author(s) (or their employer(s)) 2020. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

To cite: Coimbra R, Edwards S, Coimbra BC, et al. *Trauma Surg Acute Care Open* 2020;**5**:e000511.

ABSTRACT

The consequences of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus have been devastating to the healthcare system.

As the positive effects of social distancing, mandatory masking, and societal lockdown on the spread of the disease and its incidence in the community were documented, societal and financial pressures mounted worldwide, prompting efforts to “re-open” countries, states, communities, businesses, and schools. The same happened with hospital, which had to start developing strategies to resume elective surgery activities. This manuscript describes the pre-requisites as well as the strategies for resuming surgical activity, be it in the outpatient or inpatient setting.

INTRODUCTION

In recent months, healthcare professionals worldwide have witnessed the devastating consequences of infection by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus. The impact has been felt in all sectors of society and it certainly was experienced firsthand by the healthcare system. Life has changed during this pandemic, and in most areas, changes are here to stay.

In the midst of this crisis, every country in the world has developed plans to contain and to mitigate the “silent enemy.” As in any pandemic, mass casualty, or disaster event, with a high number of victims, healthcare professionals do their best under difficult circumstances to save as many lives possible and to preserve the most life-years. During the COVID-19 pandemic, healthcare facilities entered into a “crisis mode.”

Although COVID-19 is primarily an infectious disease problem, the extended use of hospital resources and the scarcity of critical care specialists has led many physicians from different specialties to mobilize and provide care in the ICUs. Surgical intensivists have not been spared and also served on the front lines.

One of the measures used to allow hospitals to surge their capacity and serve the patient population with COVID-19 infection was the suspension of elective activity, most importantly elective surgery and other procedures.

At the beginning of the crisis period, when hospitals were preparing for a significant surge in the number of patients requiring hospitalization, several surgical professional organizations developed recommendations and guidelines regarding surgical and perioperative preparation, case selection,

operating room setup, anesthesia considerations, staff preparation, and postoperative care.^{1–3} Priority was given to emergency general surgery, trauma, and time-sensitive diseases, for which delay would compromise outcomes.^{4–6}

The period of social distancing, mandatory masking, and societal lockdown was critical to change the prevalence and the incidence of the disease and to decrease its reproductive rate. Consequently, a reduction in hospital and ICU admissions, as well as in mortality occurred over time. After approximately 6–8 weeks of “crisis mode” management, societal and financial pressures mounted worldwide, prompting efforts to “re-open” countries, states, communities, businesses, and schools.^{7,8}

The current dilemma now centers on the means by which to restore medical and surgical care to those who had care postponed. Guidance has been provided by the federal government, state agencies, professional organizations, and public health departments, each with its own focus.^{1,7,9–14}

Since the impact of the pandemic on healthcare delivery has varied in different locations, with some being more affected than others, we aim to provide general and practical recommendations on several aspects involved in the decision to resume surgical care and how to do it.

CONSIDERATIONS AND BASIC PRINCIPLES PRIOR TO RESUMING ELECTIVE SURGICAL CARE

Most agree that adding additional burden to an already strained healthcare system dealing with COVID-19 infection should be avoided. Therefore, when considering resuming elective surgical care, the first step is to understand the COVID-19 infection prevalence and incidence in the community and the current impact in a hospital. An assessment of current occupancy and hospital bed utilization, ICU and ventilator availability, as well as other hospital resources such as nursing, ancillary personnel, blood bank, laboratory services, pharmacy, outpatient clinics, and hospital environmental services are critically important to the estimation of whether or not resources will be available to accommodate an increase in the number of surgical patients.¹⁵

Most recommendations from public health officials have suggested that a steady decrease in the number of new COVID-19 cases over a period of 14 days (decreased incidence), associated with a similar trend in hospital and ICU admission, is necessary to consider resuming elective surgery (box 1).¹ As stated above, hospital resources must be available to support high-quality surgical care

Box 1 Initial assessment prior to reopening elective surgical care

COVID-19 incidence in the community and hospital resource availability

- ▶ Sustained reduction in rate of new COVID-19 cases in the community for at least 2 weeks.
- ▶ Sustained reduction in rate of new COVID-19/PUI hospital admissions for at least 2 weeks.
- ▶ Sustained reduction in rate of new COVID-19/PUI ICU admissions for at least 2 weeks.

Assessment of hospital resource availability

- ▶ Hospital no longer functioning in surge or crisis mode.
- ▶ X% of hospital beds available for non-COVID-19/PUI patients.*
- ▶ X% of ICU beds available for non-COVID-19/PUI patients.*
- ▶ X% of ventilators available for non-COVID-19/PUI patients.*
- ▶ Normalization of supply chain.
- ▶ Personal protective equipment availability to sustain 50%, 75%, and 100% of regular surgical volume (staged reopening).

Availability of medications and pharmacy resources

- ▶ Sedatives.
- ▶ Analgesics.
- ▶ Paralytics.
- ▶ Antibiotics.
- ▶ Others.

*% of hospital beds, ICU beds, and ventilators available is different in different hospitals and the number should be individualized to determine adequate provision of surgical care.

delivery. Although recommendations are not clear in this regard, it is imperative that the hospital is no longer functioning in “crisis mode.”

Each hospital must make an assessment of general ward and ICU bed availability as well as ventilators available for non-COVID-19 patients, below which elective surgical care could be compromised by the use of those resources for COVID-19-positive patients (box 1). It is possible, for example, that many hospital systems would be considered strained if 75% of available ward beds, ICU beds, and ventilators were being used at any given time.

Another important aspect related to the assessment of hospital resources is that of supply chain restoration and the availability of enough personal protective equipment (PPE) to adequately sustain the increase in surgical volume planned to occur at the institution. It is advisable that these assessments be performed when considering a staged increase in cases over a certain period of time.

Another critical element in the initial assessment is the ability to offer reliable COVID-19 testing to all patients undergoing an elective surgical procedure. Testing is particularly important because available scientific evidence suggests worse postoperative outcomes in patients who test positive for COVID-19, regardless of the presence of symptoms or contact history.^{16–18} Current recommendations suggest that a molecular test (RT-PCR) is preferred and the patient’s sample be collected at a maximum of 72 hours prior to the time of the procedure.¹⁹ If the test result is positive, the case should be canceled. Patients should be instructed to quarantine at home after the nasal and oropharyngeal swabs are collected and sent for testing, until the day of surgery. If the sample is not collected within 72 hours,

even if the test result is negative, a rapid molecular test should be done on the day of the procedure as a safety measure. It is important to emphasize that a negative test does not diminish the importance of adequate use of PPE for the surgical, anesthesiology, and nursing teams.

The detailed assessment of the case backlog and the development of a case prioritization system is of great importance and is influenced by the characteristics of each facility and the types of procedures (inpatient vs outpatient) in question.¹⁴⁸ Some hospitals may opt for resuming high-volume elective outpatient surgery only, while maintaining a more rigid case selection in the inpatient setting (eg, transplantation, cancers following adjuvant therapy), while others may have enough capacity and resource availability to resume both elective inpatient and outpatient surgeries. Other variables to be considered in case prioritization include the need for ICU admission in the immediate postoperative period, risk of harm if case is delayed, expected need for blood transfusions, and hemodialysis.

STAGED SYSTEM TO RESUME ELECTIVE SURGERY

The strategy to resume elective surgery varies according to the institution and one model does not fit all. However, it is important that a staged system be implemented with partial reopening followed by interval full reassessment of the system, as the incidence of COVID-19 infection may have decreased further, allowing the opening of more operating rooms, increasing the overall number of procedures performed.

Stage 1

In the initial stage, hospitals with outpatient surgical areas may opt for resuming elective surgery in a “COVID-19 free area,” while other hospitals without such facilities may split their operating rooms, dedicating a certain number of rooms exclusively for outpatient elective surgery and using the remaining of the operating rooms to prioritize time-sensitive diseases such as cancer, transplantation, emergency surgeries, and trauma. Urgent/emergent cases should follow a prioritization system enforced by an oversight committee composed of surgeons, anesthesiologists, and operating room nursing staff.¹⁹ As this strategy compromises pre-COVID-19 block time grids already in place, finding an equitable system to serve all surgical services and using an “open block” strategy may prove to be fair, patient centered, and safe. The duration of the initial stage of reopening (stage 1) will vary depending on the epidemiology of the COVID-19 infection in the community, the number of cases in the hospital, and an assessment of resource utilization as previously described. Principles to be adhered to during stage 1 are described in box 2.

It is critically important that hospitals provide reassurance to patients that the hospital environment is safe and equipped to provide high-quality care for surgical patients. This is accomplished by developing a patient education and communication strategy outlining the measures undertaken by the institution to avoid cross-contamination, screening measures in clinic or at the preoperative check-in area, and the importance of preoperative testing, in addition to the risks and benefits associated with a potential additional delay in undergoing surgical treatment (box 3).

For patients arriving at the hospital on the day of surgery, regardless of being an inpatient or an outpatient surgical case, a series of measures would provide additional safety and assurance to patients and the surgical team. Universal masking should be enforced in the preoperative setting, and all patients should be given a surgical mask at the entrance of the facility on the

Box 2 Principles during the initial reopening—stage 1
DO NO HARM.

Patient safety

- ▶ Separate pathways for traffic in the hospital separate from COVID-19.
- ▶ “Clean Areas.”
- ▶ Every surgical patient must be tested preoperatively.

Team safety

- ▶ Availability of protective equipment.
- ▶ Well-defined functions for all team members.
- ▶ No scrub team breaks during case, when possible.
- ▶ Minimizing personnel in OR (no medical students in stage 1).
- ▶ Safety equipment, including smoke evacuators for laparoscopic cases and careful use of aerosolizing instruments such as electrocautery and laser.^{22 23}
- ▶ OR deep cleaning between cases.
- ▶ No elective surgery on COVID-19+ patients during stage 1.
- ▶ Explain safety measures in place in the hospital to all patients.
- ▶ Testing OR staff and surgeons for COVID-19 infection regularly.

day of surgery. Then, a screening questionnaire including exposures and symptoms since the swabs were collected must take place. A rapid test may be necessary in patients who were tested outside of the 72-hour preoperative window or requiring urgent operations. During stage 1, visitation policies should be strict and family members of elective surgery patients should not be allowed in waiting areas, except for patients in the pediatric age group, respecting the masking and social distancing policies of the facility.

For outpatient surgical cases, families should be instructed to wait in the parking lot of the hospital until the surgical team establishes communication via telephone with them. Written postoperative instructions should be provided to the patient and communicated to the patient’s family through a telephone call prior to discharge, including the postoperative clinic visit, either in person or via telemedicine.²⁰ Many facilities are already implementing curbside patient pickup to avoid unnecessary traffic in the hospital (box 4). For patients requiring hospitalization, the surgical team will communicate with family members via telephone or videoconferencing.

Patients who test positive for COVID-19 in the preoperative assessment should promptly receive these results. Consideration should be made for the creation of a reporting script that

Box 3 Explaining risks and providing reassurance to patients

- ▶ Explain risk of surgery in COVID-19+ patients.
 - Value of testing.
 - Importance of disclosing to surgeons any contacts with COVID-19+ patients and pre-op symptoms.
 - Post-op consequences of an operation in patients with COVID-19.
- ▶ Explain risk of being treated in a hospital during the COVID-19 pandemic.
 - Risk of acquiring COVID-19 while in the hospital.
 - Potential for delaying operation and risks versus benefits.

Box 4 Recommendations on the day of surgery

- ▶ No family members allowed in the waiting/recovery areas.
- ▶ All patients should use surgical masks since entrance of hospital.
- ▶ Screening with questionnaire—symptoms (not ideal).
- ▶ If questions and previous test >72 hours → retest with RAPID TEST.
- ▶ All patients should use surgical masks in the recovery room.
- ▶ Written discharge instructions to patient.
- ▶ Post-op phone call to family/proxy—repeat discharge instructions.
- ▶ Set up curbside pickup.
- ▶ Telemedicine visit in 2 weeks for postoperative check.
- ▶ Immediate communication by the surgeon to the patient about a preoperative COVID-19-positive test.

practitioners may use in communication with patients. Information regarding signs and symptoms of worsening infection and indications for emergent assessment should be provided. The process by which the patients will be reassessed and rescheduled for surgery following infection resolution should also be included in this correspondence.

An example of an implementation plan for stage 1 is depicted in figure 1, encompassing all the perioperative steps. In addition, specific pre-requisites are listed, including the adequate supply of special materials commonly used in orthopedic surgery, robotic operations, and so on, with appropriate technical support from industry via intraoperative teleconferencing when feasible. A modified informed consent process is provided, which should be done exclusively by the surgeon and not delegated to fellows or house staff.²¹ In addition, a proposed schedule is outlined for obtaining the nasal and oropharyngeal swabs in relation to the date of surgery assuming current systems allow results to become available in 24 hours.

Stage 2

After a functional period in stage 1, a reassessment of the COVID-19 infection in the community and in the hospital should occur to determine if adding operating room capacity and increasing the number of surgical cases is warranted. As an example, a hospital that initially reopened for outpatient surgeries may in stage 2 consider increasing inpatient cases. Hospitals that opened for both outpatient and inpatient cases, at a limited capacity (eg, 50% capacity), may increase, in stage 2, to 75%. Obviously, the model has to be tailored to each institution. However, a few details must be contemplated (box 5). Should the distribution of operating room time be in an “open block” fashion or should the block time grid be reconfigured for a limited number of weeks only, prior to complete reopening (stage 3)? To be equitable and fair with all surgical services, hospitals may contemplate extending the operating room hours for elective procedures to accommodate all requests. Once again, after a period of time, the whole strategy must be reassessed prior to transitioning to the next and final stage.

Stage 3

Stage 3 may commence when the full capacity of the operating rooms is used by the surgical services. Many safety measures employed in early stages, such as preoperative testing, mandatory masking in the preoperative period and in the recovery room, use of appropriate PPE, and safety measures to prevent

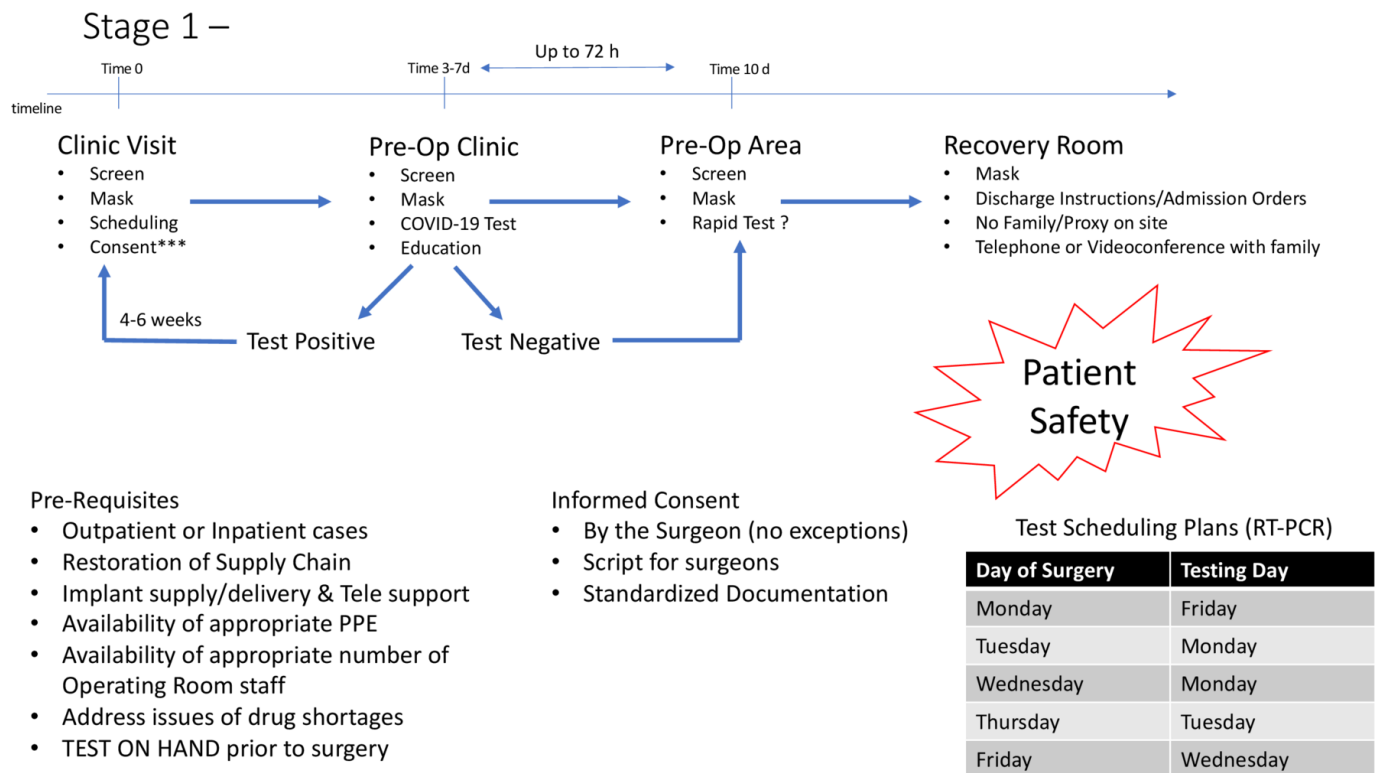


Figure 1 Example of implementation plan for stage 1.

cross-contamination must continue. The pre-COVID-19 block time grid is reinstated, and the strategy must be re-evaluated considering the incidence of COVID-19 infection in the community, use of hospital resources, including bed utilization and ICU capacity, as more complex surgical cases will be performed over time.

Final considerations

Surgeons during the COVID-19 pandemic have shown once again their remarkable ability to adapt, be flexible, and lead. Many have served on the front lines, while others continued to provide emergency surgical care for patients in need with trauma or other acute surgical conditions. As we start contemplating the process of safe resuming elective surgical services, we are faced with the unavoidable fact that some aspects of our practice and our professional behavior have changed forever and that, now more than ever, patient and team safety are critically important. We must shift our mind set from the “crisis mode” to the “new normal mode,” and continue to strive for excellence, safety, and

quality. If during the pandemic we sometimes have had to improvise, were forced to change the standard of care, and did things a little bit differently than usual, even if momentarily, to adapt to the situation in the operating room, now it is time to take a step back and reflect that nothing short of high quality of care and excellent surgical outcomes is acceptable.

Contributors RC developed the study design. BCC, SE, RC performed literature search. All authors contributed equally for manuscript writing and revisions.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; internally peer reviewed.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iD

Raul Coimbra <http://orcid.org/0000-0002-3759-6851>

REFERENCES

- 1 American College of Surgeons. Local Resumption of Elective Surgery Guidance. 2020. <https://www.facs.org/covid-19/clinical-guidance/resuming-elective-surgery>.
- 2 Coimbra R, Edwards S, Kurihara H, Bass GA, Balogh ZJ, Tilsed J, Faccincani R, Carlucci M, Martínez Casas I, Gaarder C, et al. European Society of Trauma and Emergency Surgery (ESTES) recommendations for trauma and emergency surgery preparation during times of COVID-19 infection. *Eur J Trauma Emerg Surg* 2020. [Epub ahead of print: 17 Apr 2020].
- 3 European Centre for Disease Prevention and Control. Guidance for health system contingency planning during widespread transmission of SARS-CoV-2 with high impact on healthcare services. <https://www.ecdc.europa.eu/en/publications-data/guidance-health-system-contingency-planning-during-widespread-transmission-sars> (Accessed 30 Mar 2020).

Box 5 Considerations for stage 2 reopening of elective surgery

- ▶ 75% of OR capacity (examples for discussion purpose only)
 - REDO blocks temporarily for this stage?
 - Continue with OPEN BLOCKS?
 - Develop contingency plan for extended hours.
 - Trauma and ACS rooms always available.
- ▶ 4-week period followed by reassessment.
- ▶ Must define elements of reassessment, likely using the same elements described previously in the “Considerations and basic principles prior to resuming elective surgical care” section.

- 4 Prachand VN, Milner R, Angelos P, Posner MC, Fung JJ, Agrawal N, Jeevanandam V, Matthews JB. Medically necessary, time-sensitive procedures: scoring system to ethically and efficiently manage resource scarcity and provider risk during the COVID-19 pandemic. *J Am Coll Surg* 2020. [Epub ahead of print: 09 Apr 2020].
- 5 Stahel PF. How to risk-stratify elective surgery during the COVID-19 pandemic? *Patient Saf Surg* 2020;14:8.
- 6 World Health Organization. COVID-19: recommendations for management of elective surgical procedures. 2020. <https://www.facs.org/about-acs/covid-19/information-for-surgeons/elective-surgery> (Accessed 30 Mar 2020).
- 7 Centers for Medicare and Medicaid Services. Re-opening facilities to provide non-emergent non-COVID-19 healthcare: phase I. <https://www.cms.gov/files/document/covid-flexibility-reopen-essential-non-covid-services.pdf> (Accessed 26 Apr 2020).
- 8 Royal College of Surgeons. Recovery of surgical services during and after COVID-19. 2020. <https://www.rcseng.ac.uk/coronavirus/recovery-of-surgical-services/> (Accessed 9 May 2020).
- 9 American Association of Orthopaedic Surgeons. Navigating the COVID-19 pandemic. American Academy of Orthopaedic Surgeons. 2020. <https://www.aaos.org/globalassets/about/covid-19/aaos-clinical-considerations-during-covid-19.pdf>.
- 10 American Society for Gastrointestinal Endoscopy. Guidance for resuming GI endoscopy and practice operations after the COVID-19 pandemic. https://els-jbs-prod-cdn.jbs.elsevierhealth.com/pb/assets/raw/Health%20Advance/journals/ymge/ASGE_Guidance_for_Reopening.pdf (Accessed 9 May 2020).
- 11 Gottlieb S, Rivers C, McClellan M, Silvis L, Watson C. National Coronavirus Response: a road map to reopening. American Enterprise Institute. 2020. <https://www.aei.org/research-products/report/national-coronavirus-response-a-road-map-to-reopening/> (Accessed 15 Apr 2020).
- 12 American College of Surgeons, American Society of Anesthesiologists, Association of periOperative Registered Nurses and the American Hospital Association. Joint Statement: Roadmap for Resuming Elective Surgery after COVID-19 Pandemic. 2020. <https://www.facs.org/covid-19/clinical-guidance/roadmap-elective-surgery>.
- 13 Gilat R, Haunschild ED, Tauro T, Cole BJ. Recommendation to optimize safety of elective surgical care while limiting the spread of COVID-19: *primum non nocere*. *Arthrosc Sports Med Rehabil* 2020. [Epub ahead of print: 27 Apr 2020].
- 14 Joint statement on re-introduction of hospital and office-based procedures in the COVID-19 climate for the practicing urogynecologist and gynecologist. *Society of Gynecologic Surgeons* 2020.
- 15 Walker JP. Resuming elective surgery at UTMB predicated on patient and staff well-being. 2020. https://www.facs.org/-/media/files/covid19/resuming_elective_surgery_at_utmb.aspx (Accessed 5 May 2020).
- 16 Lei S, Jiang F, Su W. Clinical characteristics and outcomes of patients undergoing surgeries during the incubation period of Covid-19 infection. *Lancet* 2020.
- 17 Aminian A, Safari S, Razeghian-Jahromi A, Ghorbani M, Delaney CP. COVID-19 outbreak and surgical practice: unexpected fatality in perioperative period. *Ann Surg* 2020. [Epub ahead of print: 26 Mar 2020].
- 18 Guan WJ, ZY N, Hu Y, Liang WH, CQ O, JX H, Liu L, Shan H, Lei CL, DSC H, *et al*. China medical treatment expert group for Covid-19. clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med* 2020;382:1708–20.
- 19 American College of Surgeons. Create a Surgical Review Committee for COVID-19-Related Surgical Triage Decision Making. 2020. <https://www.facs.org/covid-19/clinical-guidance/triage>.
- 20 Hakim AA, Kellish AS, Atabek U, Spitz FR, Hong YK. Implications for the use of telehealth in surgical patients during the COVID-19 pandemic. *Am J Surg* 2020. [Epub ahead of print: 21 Apr 2020].
- 21 Bryan AF, Milner R, Roggin KK, Angelos P, Matthews JB. Unknown unknowns: surgical consent during the COVID-19 pandemic. *Ann Surg* 2020.
- 22 Bigony L. Risks associated with exposure to surgical smoke plume: a review of the literature. *Aorn J* 2007;86:1013–24. quiz 1021-4.
- 23 Karsai S, Däschlein G. "Smoking guns": hazards generated by laser and electrocautery smoke. *J Dtsch Dermatol Ges* 2012;10:633–6.