



## Perspectives

# Perspectives on Surgery in the Time of COVID-19: Safety First

Primum non nocere: First, do no harm. This is a professional and ethical imperative with which we as physicians are very familiar. Can we expand this principle to include the patient and the healthcare team? As minimally invasive surgeons and ambassadors, the authors could never have imagined penning a document that argues the merits of traditional open surgery. We are all ardent supporters of minimally invasive techniques and the myriad benefits they afford. However, we now find ourselves in the midst of a global crisis from the coronavirus disease 2019 (COVID-19) pandemic; a time when the word “unprecedented” has taken on new meaning. Since early March, it has been reported that more than 3300 healthcare workers in China were infected with COVID-19, whereas in Italy, upward of 20% of healthcare workers have been infected with news reports of more than 50 deaths among physicians [1].

Significant and realistic concerns have been raised regarding the risk of severe acute respiratory syndrome coronavirus (SARS-CoV)-2 (the virus responsible for COVID-19 disease) dissemination during minimally invasive surgery owing to pneumoperitoneum-associated aerosolization of particles and the presence of the virus in blood and stool [2]. It is important to recognize that our understanding of viral aerosolization by electrosurgical or ultrasonic tools comes from work with other viral diseases, such as hepatitis B [3]. Particles in surgical smoke have been demonstrated to contain a variety of toxic and virulent materials thought to be potentially capable of infecting those who inhale them, with case reports of doctors contracting a rare papillomavirus when surgical smoke exposure was suspected to be the source [4]. The plausibility of aerosol and fomite transmission of SARS-CoV-2 has been established, with similar findings to that of SARS-CoV-1 (the virus responsible for a multinational disease outbreak in 2002–2003), which was associated with nosocomial transmission and superspreading events [5]. There have been particular concerns raised about laparoscopic surgery because of the higher concentrations of particulate matter that occur compared with open surgery, which may be due

to the electrosurgical devices employed, the low gas motility of pneumoperitoneum, and gas expulsion through ports or trocars [4].

Regarding COVID-19 specifically, we emphasize that there are no data on surgical exposures translating into a definitive risk to the operating room team. With a dearth of scientific evidence to guide us, the healthcare community is left with 2 solutions. The first involves continuing on with normal practice unless it becomes clear that these practices are definitively harmful. Proponents of maintaining the status quo will no doubt highlight the fact that the scientific community is too early in our understanding of COVID-19 to have proven a causal link between surgical exposures and infection of healthcare workers. Surgeons may argue that there is no evidence specific to laparoscopic plume containing SARS-CoV-2 resulting in infection. The rebuttal to this stance is that neither is there evidence of safety. The authors suggest championing an alternative solution whereby we as a medical community become proactive rather than reactive, adopting a conservative yet balanced plan to protect both the patient and the healthcare team. When faced with a biologically plausible concern that could infer serious harm, we are obligated to act with an abundance of caution, examining and questioning our standard practices.

Certainly, it is uncomfortable to consider changing practice in the absence of definitive evidence, but let us consider whether it will be possible to obtain such evidence either now or in the foreseeable future. The necessary studies on this subject would require lengthy follow-up, be difficult to conduct, and expose a vast number of staff to potential risk in the process. Equipose concerns may preclude such work taking place in the in vivo setting. Reliable information on this subject is not likely forthcoming anytime soon, and yet we are required to act now to alter practice if we wish to avoid exposure risks. We must bear in mind that the absence of data is not data in and of itself, or taken another way, just because surgical exposures have not been proven to be harmful, does not mean that it is safe to proceed with usual practice. The reality is that decision making and guideline development in this arena will be based on the limited available data and the information inferred from other viruses and similar epidemics.

---

The authors declare that they have no conflict of interest.

Taking the aforementioned discussion into account, we propose the following management algorithm. In patients who are COVID-19 positive, unless they have a life-threatening emergency that requires surgery, we advocate for nonoperative treatment and delay of surgery until recovered. If surgery cannot be delayed for a patient who is COVID-19 positive, a laparotomic operation should be performed. In patients with unknown COVID-19 status, preoperative testing is ideal when available, although it is important to also consider the test's sensitivity/specificity and underlying degree of suspicion on the basis of symptoms and local disease prevalence. Laparoscopy can be performed in a patient whose COVID-19 status is unknown if the entire operating room team has access to necessary personal protective equipment and extreme care is taken to prevent release of pneumoperitoneum into the operating theater. If these measures are not in place, an open operation is the alternative. The many advantages of laparoscopy are well-known, and it is important to stress that there will be cases and patients for whom the risks of a laparotomy far outweigh the risks of laparoscopy, even when taking into account utilitarian concerns for the healthcare team regarding potential exposure issues. Outside of these unique situations, however, the use of laparoscopy should be reserved for the patient who is COVID-19 negative; or in the absence of testing, in patients who are symptom- and exposure-screened negative with full deployment of personal protective equipment (Supplemental Fig. 1).

We must also keep an open mind to alternatives to traditional minimally invasive surgery, which may be appropriate in most cases during this pandemic. With the suspension of nonessential procedures, many of the emergent benign gynecologic cases that we will be approaching in patients who are COVID-19 positive or unknown status (such as ovarian torsion or ectopic pregnancy) could be accomplished through minilaparotomy with little to no use of electrosurgery and same day discharge. This approach could prove to optimize benefits to both the patient and the healthcare team. In addition, regional anesthesia is feasible with this technique, which could allow for further limitation of healthcare team exposures related to the aerosol-generating procedures of intubation and extubation. Whether operating using minimally invasive or open techniques, effective mechanisms exist for the removal of smoke and particulate matter that can significantly reduce the surgical team exposure. Whenever possible, electrosurgical/ultrasonic device use should be coupled with a smoke evacuation/filtration system.

It is our fervent hope that as more data comes to light, the arguments made in this piece may no longer be

applicable. With more accurate, rapid, and available testing for COVID-19, including serum tests of markers of acute infection and immunity, the decision making will become more streamlined. In addition, if future evidence demonstrates a lack of infectivity of the aerosolized, blood, or fluid-borne viral particles, then the aforementioned discussions may become moot. Until such time, however, let us not allow blind allegiance to 1 approach be the primary factor determining surgical route. The best outcomes for all can be achieved when individual patient and local circumstances are considered, along with surgical experience and judgment.

Sarah L. Cohen, MD, MPH,<sup>a,\*</sup> Grace Liu, MD, MSc,<sup>b</sup>  
Mauricio Abrao, MD,<sup>c</sup>  
Neil Smart, MBBS (Hons), PhD, FRCSEd,<sup>d</sup>  
Todd Heniford, MD<sup>e</sup>

<sup>a</sup>Division of Gynecology, Mayo Clinic, Rochester, Minnesota

<sup>b</sup>University of Toronto, Toronto, Canada

<sup>c</sup>University of São Paulo, São Paulo, Brazil

<sup>d</sup>Royal Devon and Exeter NHS Trust, Exeter, United Kingdom

<sup>e</sup>Department of Surgery, Carolinas Medical Center, Charlotte, North Carolina

\*Corresponding author: Sarah Cohen, Division of Gynecology, Mayo Clinic, 200 First Street SW, Rochester MN 55905.

E-mail: [scohen20@partners.org](mailto:scohen20@partners.org)

### Supplementary materials

Supplementary material associated with this article can be found in the online version at <https://doi.org/10.1016/j.jmig.2020.04.003>.

### References

1. The Lancet. COVID-19: protecting health-care workers. *Lancet*. 2020;395:922.
2. Zhang W, Du RH, Li B, et al. Molecular and serological investigation of 2019-nCoV infected patients: implication of multiple shedding routes. *Emerg Microbes Infect*. 2020;9:386–389.
3. Kwak HD, Kim SH, Seo YS, Song KJ. Detecting hepatitis B virus in surgical smoke emitted during laparoscopic surgery. *Occup Environ Med*. 2016;73:857–863.
4. 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. [Epub ahead of print].
5. van Doremalen N, Bushmaker T, Morris DH, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *N Engl J Med*. 2020 Mar 17. [Epub ahead of print].