



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

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

Sarah L. Cohen MD MPH , Grace Liu MD MSc ,
Mauricio Abrao MD , Neil Smart MBBS (Hons) PhD FRCSEd ,
Todd Heniford MD

PII: S1553-4650(20)30172-2
DOI: <https://doi.org/10.1016/j.jmig.2020.04.003>
Reference: JMIG 4100



To appear in: *The Journal of Minimally Invasive Gynecology*

Received date: 31 March 2020

Accepted date: 1 April 2020

Please cite this article as: Sarah L. Cohen MD MPH , Grace Liu MD MSc , Mauricio Abrao MD , Neil Smart MBBS (Hons) PhD FRCSEd , Todd Heniford MD , Perspectives on Surgery in the time of COVID-19: Safety First, *The Journal of Minimally Invasive Gynecology* (2020), doi: <https://doi.org/10.1016/j.jmig.2020.04.003>

This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

© 2020 Published by Elsevier Inc. on behalf of AAGL.

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

Authors:

Sarah L. Cohen¹ MD MPH, Grace Liu² MD MSc, Mauricio Abrao³ MD, Neil Smart⁴ MBBS (Hons) PhD FRCSEd, Todd Heniford⁵ MD

Affiliations:

- 1: Division of Gynecology, Mayo Clinic, Rochester, MN, USA
- 2: University of Toronto, Toronto, Canada
- 3: University of São Paulo, São Paulo, Brazil
- 4: Consultant Colorectal Surgeon at Royal Devon and Exeter NHS Trust
- 5: Department of Surgery, Carolinas Medical Center, Charlotte, NC, USA

Conflict of Interest statement:

No pertinent disclosures exist, any financial disclosures are outside the scope of this work.

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 health care 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 (COVID-19) pandemic; a time when the word 'unprecedented' has taken on new meaning. As of early March, it has been reported that over 3,300 health care workers in China were infected with COVID-19, while in Italy upwards of 20% of health-care 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 due to pneumoperitoneum-associated aerosolization of particles, as well as 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 super-spreading events (5). There have been particular concerns raised about laparoscopic surgery due to 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 via ports or trocars(4).

Regarding COVID-19 specifically, we emphasize that there is 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 health care community is left with two 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 health-care 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 health-care 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. Equipoise 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 haven't been proven to be harmful, doesn't 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 information inferred from other viruses and similar epidemics.

Taking the above 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 non-operative treatment and delay of surgery until recovered. If surgery cannot be delayed for a COVID-19 positive patient, 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 sensitivity/specificity and underlying degree of suspicion based on symptoms and local disease prevalence. Laparoscopy can be performed in a COVID-19 unknown status patient 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 theatre. 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 health-care team regarding potential exposure issues. Outside of these unique situations, however, the use of laparoscopy should be reserved for the COVID-19 negative patient; or in the absence of testing, in symptom- and exposure-screened negative patients with full deployment of personal protective equipment (Supplemental Figure 1).

We must also keep an open mind to alternatives to traditional minimally invasive surgery which may be appropriate in a majority of cases during this pandemic. With the suspension of non-essential procedures, many of the emergent benign gynecologic cases we will be approaching in COVID-19 positive or unknown patients (such as ovarian torsion, ectopic pregnancy) could be accomplished via minilaparotomy with little to no use of electrosurgery and same day discharge. This approach could prove to optimize benefits to both the patient and health-care team. Additionally, regional anesthesia is feasible with this technique, which could allow for further limitation of health-care team exposures related to the aerosol-generating procedures of intubation and extubation. Whether operating via 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. Additionally, if future evidence demonstrates lack of infectivity of the aerosolized, blood or fluid-borne viral particles, then the discussions above may become moot. Until such time, however, let us not allow blind allegiance to one approach to be the primary factor determining surgical route. The best outcomes for all can be achieved when individual patient and local circumstances are taken into account, along with surgical experience and judgement.

REFERENCES

1. COVID-19: Protecting health-care workers. *The Lancet*. 2020; 395 (10228): 922.
2. Zhang W, Du RH, Zheng XS, et al. Molecular and Serological Investigation of 2019-nCoV Infected Patients: Implication of Multiple Shedding Routes. *Emerg Microbes Infect*. 2020; 9(1): 3865-389.
3. Kwak HD, Kim SH, Seo YS, et al. Detecting hepatitis B virus in surgical smoke emitted during laparoscopic surgery. *Occup Environ Med*. 2016;73(12):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; Available online: <https://journals.lww.com/annalsurgery/Documents/Minimally%20invasive%20surgery%20and%20the%20novel%20coronavirus%20outbreak%20-%20lessons%20learned%20in%20China%20and%20Italy.pdf>. [Epub ahead of print]
5. Vav Doremale N, Morris DH, Holbrook MG, et. al. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *N Engl J Med*. 2020. doi: 10.1056/NEJMc2004973. [Epub ahead of print]