laparoscopic surgery
&
COVID-19

Alireza FARSHI,MD,MBA

What We Have Learned

- COVID-19 - coronavirus SARS-CoV-2

  - COVID-19, zoonotic virus, spread from animals to humans
  - Human to human droplet transmission: coughing, sneezing

  - Virus thought to originate/mutate from bat to pangolin to human
  - Key symptoms: fever, cough, SOB, chills, repeated shaking with chills, muscle pain, headache, sore throat, new loss of taste/ smell
  - At risk groups: 60+, diabetes, HPB, kidney disease; comorbities

- Considering the risks for the healthcare personnel in the operating room to contract the virus, most of the surgical services for elective procedures have been discontinued.

- If a patient presents with a potentially life-threatening condition that requires immediate surgical treatment and the situation does not allow time for the RT-PCR result, they should be considered a SARS-CoV-2 carrier.

- Between 18% and 50.5% of COVID-19 patients are asymptomatic carriers and can potentially transmit the disease.

- A novel human coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), emerged in Wuhan, China, at the end of 2019 leading to the current pandemic.
- It is an RNA virus whose size is 0.12 microns (µm).
- It can be found in the nasopharynx, the upper and lower respiratory tract, and in the entire gastrointestinal tract, from the mouth to the anus.
- Theoretically, the virus is still viable in aerosols for at least 3 hours and remains transmissible.
- Vertical transmission from mother to child has not been demonstrated. The RNA of SARS-CoV-2 has not been found in samples from the umbilical cord blood, vaginal discharge, or breast milk.

- The concentration of particles in surgical plume after 10 minutes of using electrosurgical devices is higher in laparoscopic vs open surgery.

- Electrocautery use during 15 minutes generates plume equivalent to the smoke generated by six nonfiltered cigarettes.

- The size of particles found in surgical plume varies from 0.05 µm to more than 25 µm and they can travel up to 1 meter from their source.

- Particles ranging from 2.5 µm to 10 µm can enter the respiratory tract and can be found as far distal as the alveoli.

- Ultrasmall particles (0.1–0.8 µm) had been found in surgical plume from laparoscopic ports after using laparoscopic monopolar cautery.
- In laparoscopic surgery, the generation of 0.3 µm particles was higher after 10 minutes of electrocautery use.
- The ultrasonic scalpel produces aerosols without a heating process. This contributes to a higher possibility of carrying viable and infectious particles compared to aerosols from high temperature (electrocautery).

- Human hepatitis virus has been found in surgical plume generated during laparoscopic surgery but its infective capacity as an aerosol has not been determined yet. Nevertheless, it is recommended to establish control methods for the surgical plume generated by electrosurgical devices.

- Some studies had identified active human papilloma virus (HPV) and human immunodeficiency virus (HIV) in surgical plume. However, the infectious capacity of these viruses for healthcare workers in the operating room is still not clear.

- In general, laparoscopic surgery has the advantage of maintaining the integrity of the abdominal wall which generates a controlled setting to allow a safe evacuation of pneumoperitoneum and aerosols generated by electrosurgical devices.
- The use of laparoscopy involves less surgical trauma for the patients compared to open surgery.
- In the case of a COVID-19-positive patient, the minimally invasive approach will likely lead to better survival rates and a faster recovery than the open approach.

- Laparoscopic surgery has clinical outcome advantages in patients including:

- those with viral infections such as HIV;
- It also poses less risk of blood and fluid exposition to surgeons,
- it has a lower recovery time, smaller incisions,
- less respiratory compromise,
- lower risk of wound dehiscence, lower incisional hernia rate, and lower surgical site infection rate.

- The implementation of effective mechanisms for surgical plume evacuation and the prevention of aerosol dissemination are required. The use of a simple and low-cost filtration system like electrostatic filters, which have the capability of efficiently filtering bacterial and viral loads, is recommended.

- The use of appropriate filters for surgical plume evacuation has been recommended by the Centers for Disease Control and Prevention (CDC) even before the pandemic.

- We are facing a situation in which we are exposed to a highly contagious virus and new information about the virus is constantly evolving given the short period of time of the pandemic.

- For this reason, we should do our best effort to minimize the risk of infection with the appropriate use of protective techniques.

- There is not clear evidence that laparoscopic surgery poses a high risk for the healthcare workers in the operating room. However, as we do not know what the real risk of transmission and infectivity is by being exposed to surgical smoke or pneumoperitoneum evacuation, we recommend avoiding venting surgical plume and pneumoperitoneum directly to the operating room environment.

- It is essential to use gas evacuation devices and in cases where they are not available, develop a low-cost filtration and suction strategy.

Adaptation of a filter to the suction system. Red arrow shows clipped adapter to prevent system leakage

THE SURGEON 19 (2021) E452–E461

COVID-19 infection risk by open and laparoscopic surgical smoke: A systematic review of the literature

Diandra Antunes, Mariam Lami, Agbim Chukwudi, Abhishek Dey, Mahul Patel, Amanda Shabana, Mohamed Shams, Zoe Slack, Giles Bond-Smith, Giovanni Tebala*

Surgical Emergency Unit, Oxford University Hospitals NHS Foundation Trust, John Radcliffe Hospital, Oxford, UK

➢ Discussion:

- Inhalation of surgical smoke can be generally hazardous, and therefore the use of PPE during surgical operations must be recommended in any case.

- However, the present systematic review of the existent Literature did not identify any significant evidence of the risk of viral transmission with the surgical smoke, therefore the current guidelines restricting the use of laparoscopy and/or diathermy during the current Covid-19 pandemic may be considered excessive and non-evidence based.

In Context: Review

Potential Risk and Safety Measures in Laparoscopy in COVID-19 Positive Patients

Surgical Innovation
2021, Vol. 0(0) 1–7


Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/15533506211003527
journals.sagepub.com/home/sri
SAGE

Fokkedien HMP Tummers, MD[1], Werner A Draaisma, MD, PhD[2], Ahmet Demirkiran, MD, PhD[3], Tammo A

➢Conclusion.

- Due to the small risk compared to widely known benefits of laparoscopy, there is no reason to replace laparoscopy by laparotomy due to COVID-19 infection. To avoid the potential small risk of viral transmission, additional safety measures are advised.

- From these data, it can be advised that the choice to perform a laparoscopy or laparotomy should not depend on COVID-19 status.

- Due to a limitation of conclusive evidence and the expected very low risk of transmission, COVID-19 is not a contraindication for laparoscopy. The surgical route should be based on surgical indication,clinical status, and experience of the surgeon.

Table 1. Summary of recommendations for urological minimally invasive surgeries during the COVID-19 pandemic.

Study	Journal/guideline	Recommendations re lap surg in COVID-19	Ref.
Pullatti *et al.*	BJUI	Surgical intervention should be considered for emergencies, for example, high grade malignancies and unstable trauma patients. All surgeons should adopt appropriate PPE (Level 3)	[9]
Ficarra *et al.*	Minerva Urol Nefrol	Uro-oncological procedures divided into four categories: nondeferrable/urgent; semi nondeferrable; deferrable cancer surgery; replicable cancer surgery (radical prostatectomy considered as semi nondeferrable ; for intermediate to high risk patients) All benign or nononcological diseases delayed until the end of the COVID-19 emergency All outpatient procedures including biopsies should be delayed until post-COVID-19 emergency All surgery to be performed by experienced surgeons with a halt to clinical trials and new technologies	[10]
Nowroozi A & Amini E	Urol J	Limit urological procedures to emergencies and life-threatening cases. This includes delaying TURPs, radical cystectomy for high risk bladder cancer, radical prostatectomy for poorly differentiated PCa and radical nephrouretectomy	[11]
Mottrie A	EAUS	There is no current evidence to demonstrate COVID-19 in the CO_2 plume created during MIS The concerns put forth by statements from SAGES and RCS may discourage surgeons from performing MIS surgery without adequate evidence Open surgery is not without viral transmission risk to the healthcare team and increases the burden on the healthcare system by increasing hospital bed occupancy with a longer length of stay MIS is superior to open surgery with regard to several patient outcomes across many disease states and conversion to open surgery represents a deviation from standard of care Because of the uncertainty surrounding COVID-19 in the CO_2 plume, measures to decrease viral exposure to the surgical team should be performed	[12]
Porter *et al.*	BJU Int.	MIS/Laparoscopic surgery should be limited to planned urgent and emergency procedures Pre-operative COVID testing of patients if feasible Limit healthcare workers in room to essential personnel Surgical training should be limited to reduce time in operating room Social distancing within OT if able to Reduce surgical plume and pressure of the pneumoperitoneum Also summarised the ERUS position statement of key points (above)	[13]

Table 1. Summary of recommendations for urological minimally invasive surgeries during the COVID-19 pandemic.

Study	Journal/guideline	Recommendations re lap surg in COVID-19	Ref.
Sobel *et al.*	Urology	Retrospective study of PPE use in different urologic procedures in an Italian single centre in March 2020. Percutaneous nephrostomy placement required the least PPE per procedure. Robotic-assisted urologic procedures consumed the most PPE per procedure	[14]
Narain *et al.*	Indian Journal of Cancer	Recommendation of deferring treatment of renal cell carcinoma from 3 to 6 months, except for patients with ongoing haematuria and/or inferior vena cava thrombus, which warrant immediate surgery Metastatic renal cell cancers should be started on targeted therapy Low grade nonmuscle invasive bladder cancers can be kept on active surveillance while high risk nonmuscle invasive bladder cancers and muscle invasive bladder cancers should be treated within 3 months Neoadjuvant chemotherapy should be avoided Management of low and intermediate risk prostate cancer can be deferred for 3–6 months while high risk prostate cancer patients can be initiated on neoadjuvant androgen deprivation therapy Patients with testicular tumors should undergo high inguinal orchiectomy and be treated according to stage without delay, with stage I patients being offered surveillance. Penile cancers should undergo penectomy, while clinically negative groins can be kept on surveillance Neoadjuvant chemotherapy should be avoided, and adjuvant therapy should be deferred	[15]
Ouzzane A & Colin P	Surgical Laparoscopy Endoscopy & Percutaneous Techniques	Surgical team protection includes a systematic screening of patients, wearing protection devices by all the operating staff and adequate management of aerosols. The risk of aerosol dispersal is particularly high during laparoscopic and robotic surgeries due to the interaction between circulating CO_2 and surgical smoke that may contain small viral particles The use of integrated insufflation devices comprising smoke evacuation and filtration mode to decrease the risk of virus transmission	[16]
Moschovas *et al.*	EU Focus	Patients with a renal tumor ≥4 cm, demonstrate stage progression, growth kinetics >5 mm/yr or deterioration of their clinical condition should be considered for surgery if possible. Patients with bleeding tumors with a hemodynamic impact, tumors with renal vein and vena cava thrombus or large tumors causing compression of adjacent organs may be considered as surgical candidates during this COVID-19 period	[17]

Eur Surg
https://doi.org/10.1007/s10353-020-00644-1

european surgery
ACA Acta Chirurgica Austriaca

Laparoscopic versus open surgery: aerosols and their implications for surgery during the COVID-19 pandemic

Janso P. Joseph · Anokha O. Joseph · Susmita Oomman · Naga V. G. Jayanthi

- **Conclusion**
- There is no reasonable evidence to suggest that laparoscopy will place surgical teams at a higher risk of COVID-19 infection than open surgery.

- During this global healthcare crisis, protecting healthcare staff from infection must be an utmost priority.

Review Article

The status of laparoscopic surgery in the COVID-19 crisis: a narrative review of current recommendations

Caroline Huynh[1]^, Katrina Duncan[1], Jonathan Ramkumar[1], Tracy M. Scott[1,2], S. Morad Hameed[1,3], Ahmer A. Karimuddin[1,2]

[1]Division of General Surgery, Department of Surgery, University of British Columbia, Vancouver, BC, Canada; [2]General Surgery, St. Paul's Hospital, Providence Health Care, Vancouver, BC, Canada; [3]Trauma Services, Vancouver General Hospital, Vancouver, BC, Canada

Contributions: (I) Conception and design: C Huynh, K Duncan, AA Karimuddin; (II) Administrative support: C Huynh, K Duncan, AA Karimuddin; (III) Provision of study materials or patients: None; (IV) Collection and assembly of data: C Huynh, K Duncan, AA Karimuddin; (V) Data analysis and interpretation: C Huynh, K Duncan, AA Karimuddin; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Ahmer A. Karimuddin, MD, MAEd, FRCSC. Co-Director, General Surgery Residency Program; Clinical Associate Professor, Department of Surgery, University of British Columbia, St. Paul's Hospital, Providence Health Care, 1081 Burrard Street, Room C310, Vancouver, BC, V6Z 1Y6, Canada. Email: AKarimuddin@providencehealth.bc.ca.

we recommend considering all surgical procedures to be aerosolizing.

Laparoscopy continues to be a safe and appropriate modality. Full airborne personal protective equipment (PPE) should be utilized in all emergent cases, and droplet PPE only in urgent elective cases for asymptomatic, screen- and test-negative patients.

Published: 20 July 2021.
doi: 10.21037/ales-20-86

Recommendations

➢ *General*

- Every patient should be considered COVID-19 positive.
- Indications for emergency surgery and urgent oncological procedures during COVID-19 pandemic should be similar as surgical indications used before the pandemic.
- The operating room should have a negative pressure system.
- The COVID-19 status of the patient should be added to the safety surgery checklist available in the institution.

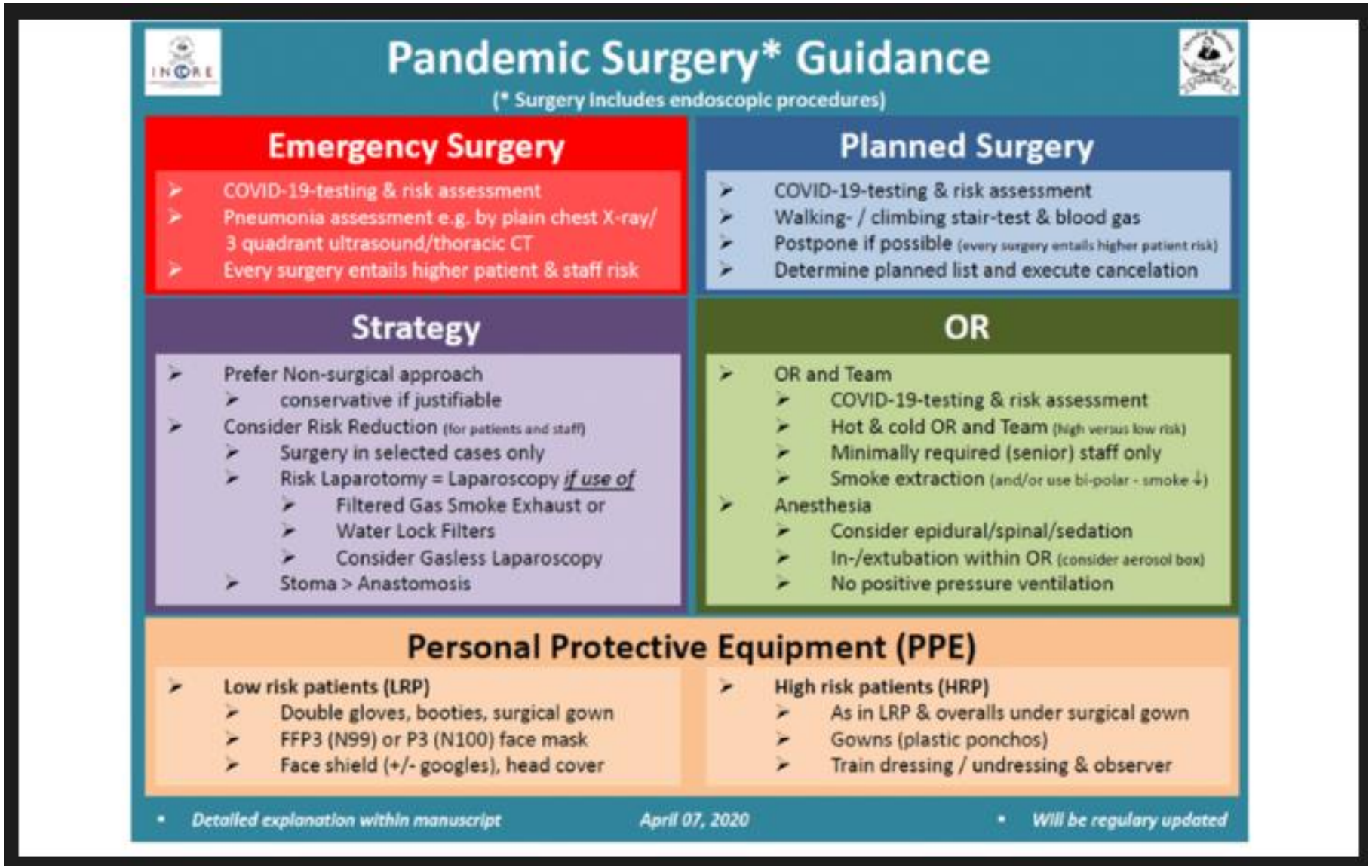
Recommendations

➢ *During Laparoscopic Surgery*

- The number and diameter of trocars should be the minimum required to safely perform the procedure.
- The intra-abdominal pressure during laparoscopic surgery should be between 8 and 12 mm Hg.
- Minimize the use of electrosurgical devices, especially ultrasonic scalpel. In case of using monopolar, the energy should be used at the lower intensity to achieve desired effects.
- Surgical plume and pneumoperitoneum should be evacuated in a controlled manner and it is recommended to use an appropriate filter to guarantee safety of healthcare workers.

Recommendations

- Port incisions should be as small as possible to avoid pneumoperitoneum leaks.
- Surgical specimen should be extracted only after the evacuation of pneumoperitoneum
- Drains should be used only if it is strictly needed.
- Fascial closure should start only after active evacuation of pneumoperitoneum.
- Hand-assisted surgery should be avoided.


Pandemic Surgery* Guidance
(* Surgery includes endoscopic procedures)
Emergency Surgery
COVID-19-testing & risk assessment
Pneumonia assessment e.g. by plain chest X-ray/ 3 quadrant ultrasound/thoracic CT
Every surgery entails higher patient & staff risk
Planned Surgery
COVID-19-testing & risk assessment
Walking- / climbing stair-test & blood gas
Postpone if possible (every surgery entails higher patient risk)
Determine planned list and execute cancelation
Strategy
Prefer Non-surgical approach
conservative if justifiable
Consider Risk Reduction (for patients and staff)
Surgery in selected cases only
Risk Laparotomy = Laparoscopy if use of
Filtered Gas Smoke Exhaust or
Water Lock Filters
Consider Gasless Laparoscopy
Stoma > Anastomosis
OR
OR and Team
COVID-19-testing & risk assessment
Hot & cold OR and Team (high versus low risk)
Minimally required (senior) staff only
Smoke extraction (and/or use bi-polar - smoke ↓)
Anesthesia
Consider epidural/spinal/sedation
In-/extubation within OR (consider aerosol box)
No positive pressure ventilation
Personal Protective Equipment (PPE)
Low risk patients (LRP)
Double gloves, booties, surgical gown
FFP3 (N99) or P3 (N100) face mask
Face shield (+/- googles), head cover
High risk patients (HRP)
As in LRP & overalls under surgical gown
Gowns (plastic ponchos)
Train dressing / undressing & observer
Detailed explanation within manuscript
April 07, 2020
Will be regulary updated

Airborne precautions for all Aerosol Generating Medical Procedures (AGMPs), including surgery, on suspected or positive COVID-19 patients

Additional precautions with laparoscopy: smoke evacuator, filtration systems, minimal number of incisions and trocars, tight air seals

Emergency surgery: pre-operative COVID-19 testing and chest CT, airborne PPE
Urgent elective surgery: pre-operative COVID-19 testing, airborne PPE if suspected or positive

Thank you