



Laparoscopic gynecological surgery in COVID-19 pandemic

Kallol Kumar Roy, MD, DNB, Rakhi Rai, MIGS, MS, Rinchen Zangmo, MD, DNB, Archana Kumari, MD, Nilofar Noor, MD, Deepali Garg, MD

Department of Obstetrics and Gynaecology, All India Institute of Medical Sciences, New Delhi, India

The major concern that has confronted surgeons during the COVID-19 pandemic is the risk of infection during surgery. So far, no studies have found SARS-CoV-2 in surgical smoke, and if it was found, whether it was infectious or not is unknown. To date, no evidence shows that respiratory viruses can be transmitted through a surgical plume or an aerosolized gas. There are various advantages of laparoscopy over laparotomy that must be kept in mind in the COVID-19 era, such as early recovery and shorter hospital stay, which can greatly help to conserve valuable hospital resources, and reduced risk of spillage of blood and body fluids, which can help to reduce transmission risk; most importantly, the distance between surgeons and between surgeons and patient is greater. Certain precautionary measures can be taken to reduce SARS-CoV-2 transmission during laparoscopy. Whenever possible, it should be the surgical option of choice.

Keywords: Laparoscopy; COVID-19; SARS CoV-2; Smoke evacuation; Pneumoperitoneum

Introduction

The COVID-19 pandemic has become a global health problem, putting a strain on the health infrastructure by diverting resources to tackle this infection. It spreads through the respiratory tract via droplets [1]. Transmission by the abdominal route is not clear [2,3]. All bodily fluids and tissues should be considered as potential sources of the virus [4].

and emergencies with acute symptoms requiring urgent care [6,7]. Laparoscopy is the best approach for certain emergency procedures, such as ruptured ectopic pregnancy and ovarian torsion [8]. However, some apprehensions do wade through the minds of surgeons worldwide about the possible risk of SARS-CoV-2 transmission through the creation of a pneumoperitoneum during laparoscopy.

Impact of COVID-19

European Society of Gynaecological Endoscopy (ESGE), Society of American Gastrointestinal and Endoscopic Surgeons (SAGES), Royal College of Obstetricians & Gynaecologists (RCOG), American Association of Gynecologic Laparoscopists (AAGL) stated that elective surgeries for benign diseases should be delayed with a shift of focus to emergency surgeries, thus allowing utilization of key resources in required areas, and that wherever possible, alternative medical management should be attempted [5]. Currently, surgical management should be performed only when the condition is life threatening, such as malignancies that are likely to progress

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Corresponding author: Rakhi Rai, MIGS, MS

Department of Obstetrics and Gynecology, All India Institute of Medical Sciences, Sri Aurobindo Marg, Ansari Nagar, New Delhi 110029, India

Email: drakhi81@yahoo.co.in

<https://orcid.org/0000-0002-8208-4126>

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Why has the concern about the infection been raised among surgeons during laparoscopic surgery?

Various theories have been proposed in this regard. It has been observed that SARS-CoV-2 is found in the stools of infected patients, which raised the alarm for possible viral transmission through the abdomen [9,10]. Another proposed theory suggests that the pneumoperitoneum leads to the creation of a stagnant heated volume of gas in the peritoneal cavity, which can lead to concentrated aerosolization of viral particles. Hence, the sudden release of this pneumoperitoneum can promote viral transmission [1]. DNA of various viruses such as human immunodeficiency virus have been found in the surgical plume produced by electrosurgery, but the risk of viral transmission has not been proven [11,12]. The laparoscopic approach is in fact usually preferred over laparotomy to reduce the risk of exposing surgeons to blood-borne viruses. Even earlier pandemics of influenza virus or other coronaviruses have not shown any transmission risk through a surgical plume or pneumoperitoneum [13]. To date, no evidence shows that respiratory viruses can be transmitted through a surgical plume or an aerosolized gas [8].

Advantages of laparoscopy over laparotomy

Laparoscopy is advantageous over laparotomy due to earlier recovery and shorter hospital stay, less risk of spillage of blood and body fluids, limited exposure to surgical smoke due to the closed space of the pneumoperitoneum, reduced risk of transmission of virus particles, and greater distance between surgeons and between surgeons and patient. Hence, the blanket approach of laparotomy for all cases during the COVID-19 pandemic is not appropriate. The RCOG and British Society for Gynaecological Endoscopy (BSGE) stated that laparoscopy should be preferred over laparotomy when appropriate [6,7].

Laparoscopy is an aerosol-generating procedure and is usually performed under general anesthesia. Although the risk of exposure is not proven, precautions need to be undertaken to minimize the possible risk of transmission. There is a fair risk of aerosolization during intubation and extubation

[8]. Aerosol formation also occurs during the release of CO₂ during port entry and removal, instrument exchange, specimen retrieval, and pneumoperitoneum deflation. Certain precautionary measures suggested by various societies (AAGL, ESGE, BSGE, and RCOG) and laparoscopic experts, which can be used to reduce the SARS-CoV-2 transmission rate during laparoscopy, are summarized below [5-8,14-21].

1. General recommendations

- Postpone all non-urgent physical visits by the patients.
- Teleconsultation should be conducted wherever possible.

2. Preoperative

- Defer non-urgent surgeries.
- Screen patients for COVID-19 by questionnaire; if feasible according to the local protocol, virology screening should be performed preoperatively for every patient.
- In cases where urgent surgery is required and COVID-19 testing is not possible, the patient should be suspected as having COVID-19.
- If COVID-19 is suspected or confirmed on testing, surgery should be postponed if possible until complete recovery occurs. If surgery cannot be postponed, full personnel protective equipment (PPE) (impervious gown, N95 mask, eye protection, protective head gear, gloves, and shoe cover) must be used by operating room (OR) personnel.
- Informed consent regarding possible exposure to COVID-19 and the subsequent consequences should be obtained from the patient.

3. Intraoperative

- Separate ORs for COVID-19 patients with appropriate donning and doffing areas must be established.
- Minimize the number of personnel in the ORs.
- Limit the movement of staff in and out of the ORs.
- Laparoscopy should be performed by an experienced surgeon, and surgical training should be avoided to minimize the time of surgery.
- Disinfect trolleys with 1% hypochlorite solution.
- Create a negative pressure environment in the ORs to reduce the transmission risk. Start air conditioners after the induction of anesthesia and temporarily stop them for approximately 20 minutes before extubation of the patient.
- Contaminated air flow should be limited by closing all OR

doors. There should be a single exit and entry through a scrub room.

- Anesthesia monitors should be covered with plastic sheets.
- Use rapid sequence induction and intubation to avoid mechanical ventilation, thereby decreasing aerosolization of the virus from the airways.
- Use a heat and moisture exchanger filter (HMEF) between the facemask and breathing circuit as it can remove 99.9% of $\geq 0.3 \mu\text{m}$ airborne particles.
- Disinfect anesthesia machines after each use.
- The surgical team should enter the OR at least 15 minutes after the induction of anesthesia.
- Minimize the degree of the Trendelenburg position.
- Intraabdominal CO_2 pressure should be kept low. Reduction in lung volume, raised airway pressure, enhanced CO_2 retention, and reduced lung compliance occur secondary to the pneumoperitoneum, increasing the perioperative risk of COVID-19.
- Port incision size should be just adequate to reduce port site leakage.
- Minimize the use of energy devices in low-power settings. Monopolar diathermy pencils with attached smoke evacuators should be used if available.
- Avoid prolonged activation of energy sources to reduce the production of a surgical plume.
- Designated members of the operating team should evacuate smoke and fumes.
- A closed smoke evacuation and filtration system using an ultralow particulate air filter that can filter 0.1-micron diameter particles should be used for controlled-release filtration of surgical plumes. The suction evacuation device should be within 2 cm of the source of the plume as for every 1 cm from the source, there is a 50% loss of capture.
- Do not open ports without attaching a CO_2 filter. Suck smoke using a suction device.
- Avoid frequent exchange of instruments.
- The sudden release of the pneumoperitoneum should be avoided, especially at the time of tissue extraction at the end of surgery. The abdominal cavity should be desufflated through a filtration system or tubing attached to a suction device.
- Suck the entire pneumoperitoneum before making an ancillary incision and at the end of surgery before remov-

ing the trocars.

- Avoid extracorporeal knots (port needs to be opened).
- Gasless laparoscopy can be considered.
- Avoid blood/body fluid spillage at the time of tissue extraction.
- Accessory ports should be removed slowly and over a blunt probe, which is removed subsequently to decrease the risk of hernia as removal cannot be performed under vision to avoid inadvertent gas leakage. The primary port should be removed under vision after the abdomen is completely deflated.
- Use of surgical drains should be kept to a minimum.
- Suture closure devices that allow gas leakage should be avoided.
- Ports $>5 \text{ mm}$ in size should be closed with a J needle device and not with an EndoClose device, which may enhance the risk of gas leakage from the abdomen.
- Fascia should be closed after desufflation.
- Path of the patient from and to the OR should be defined.

4. Postoperative

- COVID-19-positive patients must be shifted by a designated team wearing PPE to a designated COVID-19 ward or an Intensive Care Unit.
- Specimens should be properly labeled as COVID-19-positive specimens and transported in a proper container to reduce the transmission risk.
- Surgeons should change scrubs and take a shower.
- At least a 1-hour gap should be maintained between 2 consecutive cases.

Gupta et al. [22] used a simple, convenient approach for aerosol diffusion during laparoscopy. They used an extra gas tubing, as was used for creating the pneumoperitoneum, which was attached to another port and then attached to a central suction device for the evacuation of surgical smoke. They used this method for 23 cases with satisfactory results and no increases in operating time or surgical difficulty. Dash and Chawla [23] reported their experience of 14 cases of gynae-laparoscopy surgery, including salpingectomy for ectopic pregnancy, total laparoscopic hysterectomy, radical hysterectomy, cystectomy, cervical cerclage, and myomectomy, and found it to be a safe alternative to laparotomy. US joint professional society statement and European joint society

statement endorsed laparoscopy as a safe surgical approach. Regardless of the theoretical risk of SARS-CoV transmission, transmission is reduced with laparoscopy if all the due precautions are taken.

In our settings, preoperative COVID-19 testing was performed for all patients. As testing of all patients is not realistic at all times, we are taking all the above precautions in the OR to protect the health care givers against SARS-CoV-2 infection.

Conclusion

While there is not enough evidence to prove the transmission of SARS-CoV through a surgical plume and pneumoperitoneum, adequate precautions must be taken to reduce the theoretical risk at all levels, making the environment safe for health care professionals. Whenever found appropriate, laparoscopy should be the surgical choice during the pandemic.

Conflict of interest

There is no potential conflict of interest relevant to this article.

Ethical approval

This study does not require approval of the Institutional Review Board because no patient data is contained in this article.

Patient consent

Written informed consent from patients is not required as this study does not involve human participants.

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