

Minimally Invasive Surgery is the Key to Patient and Operating room team Safety During the COVID19 Pandemic as well as in the “new normal” or chronic Pandemic State to come

Editor

The issue of protecting the operating room (OR) team from patient infection transmission is well known. When energy-driven instruments were introduced, surgical smoke, potentially containing bacteria and viruses¹, became an additional danger for the OR team. Consequently, when SARS-CoV-2 appeared, several surgical societies all too quickly published “safe practice” guidelines and recommendations^{2,3}, selecting laparotomy over laparoscopy when surgery was unavoidable. Societies focused on Minimally Invasive Surgery challenged these over-conservative and unfounded sanctions, leading to contradicting recommendations, leaving surgeons confused with no clear advice when to perform laparoscopy or laparotomy. As the COVID pandemic tide ebbs, hospitals are now preparing to restart elective surgery. Based on a review of the guidelines and recommendations with regard to the surgical approach (laparoscopy *vs.* laparotomy) as well as the literature regarding operations on COVID positive patients, we herein provide an educated pathway for the surgical approach for COVID-19 positive patients during the current pandemic and in the chronic pandemic state to come, highlighting the protection of OR teams until immunization becomes available.

In cases of emergency or oncological surgery the decision whether to perform abdominal surgery by laparotomy or laparoscopy is dependent on the COVID-19 status, the complexity of the operation, and the respiratory status.

COVID-19 status

In general, elective surgery is not recommended for patients who are COVID-19 positive and should be delayed until their COVID-19 status returns to negative. Obviously, however, emergent and oncological surgery for COVID-19 positive patients cannot always be postponed.

Complexity of the operation

A procedure with low complexity may be defined as one of short duration, not requiring particular laparoscopic skills, and where ICU admission is not anticipated. A procedure with high complexity may be defined as one with anticipated long ventilation time, hemodynamic instability, protracted Trendelenburg position, with anticipated substantial abdominal adhesions, when significant laparoscopic expertise is needed but unavailable, or when ICU admission is foreseen.

Assessment of respiratory status





pneumoperitoneum affects pulmonary and cardio-vascular functions causing increased intrathoracic pressure and decreased venous return in hypovolemic patients. Patients with severe hypoxemia and reduced lung compliance carry a significant risk for pulmonary barotrauma in case of mechanical ventilation. COVID-19-related acute respiratory distress syndrome (ARDS) however, behaves differently from ARDS caused by other diseases⁴ and lung compliance is relatively normal in more than 70% of patients. Therefore, patients with **normal respiratory function** with either no or mild symptoms can be operated safely by laparoscopy, again, when the expertise is available.

Patients with **moderately compromised respiratory function**

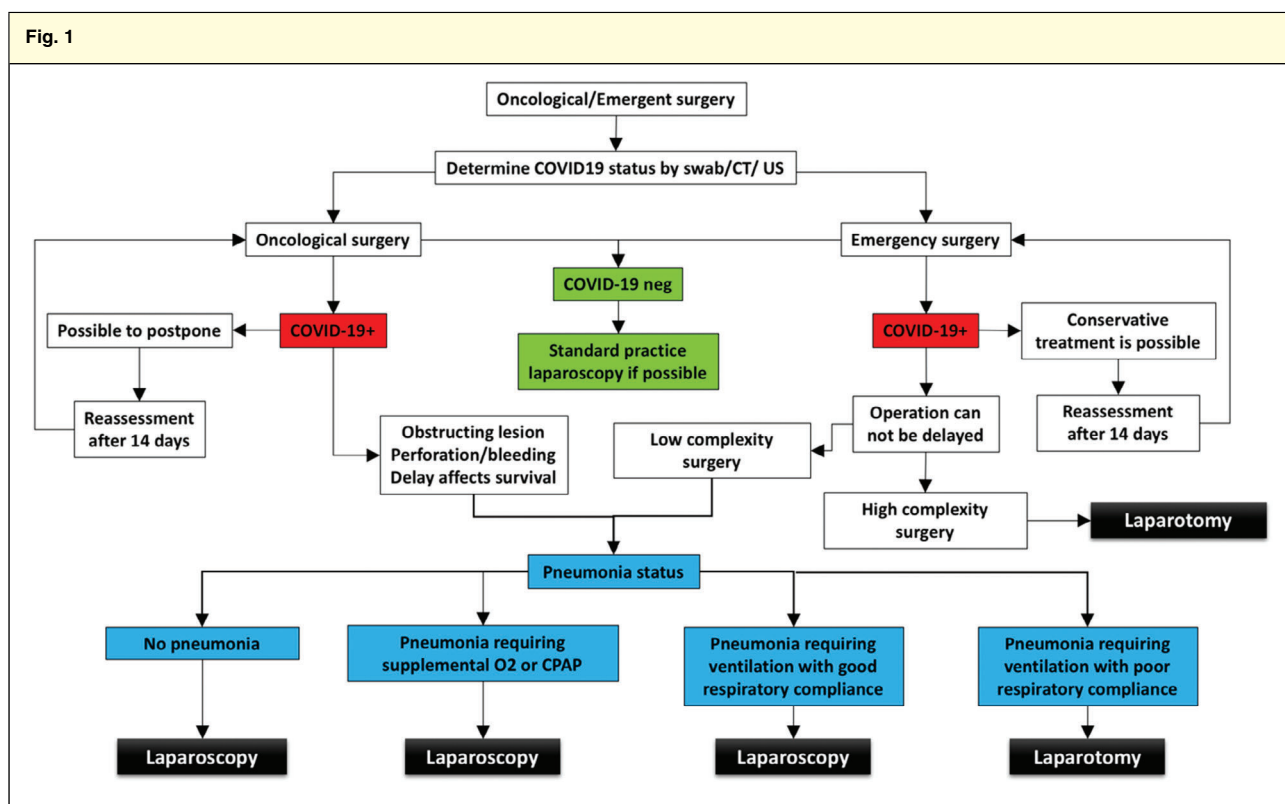
requiring mask oxygen therapy or non-invasive ventilation (*i.e.* Continuous Positive Airway Pressure) can also be operated safely by laparoscopy. Patients with **moderately to severely compromised respiratory function** with interstitial pneumonia and ARDS, who are ventilated but have good respiratory system compliance (> 50 ml/cm H₂O) can be safely operated *via* laparoscopy. Patients who are ventilated and have poor respiratory system compliance (< 40 - 50 ml/cm H₂O) are at risk for pulmonary barotrauma: the cumulative effects of pneumoperitoneum in this particular patient population may be detrimental, and until more evidence-based data accumulates, laparoscopy is contraindicated.

At the present time, aside from the potential pulmonary repercussions, there is no evidence that laparoscopy is more dangerous than laparotomy for patients with COVID-19 disease⁵. The well-recognized advantages of laparoscopy (less post-operative pain, fewer complications, faster recovery and shorter hospital stay) have a direct positive effect on improving hospital resources and costs, and in the long run, the turnover of beds, so that hospital personnel is available to care for other patients.

The following decision tree integrates these three major factors in the decision to choose between laparotomy or laparoscopy for abdominal surgery (*Fig. 1*).

Yoav Mintz¹ , Alberto Arezzo² , Luigi Boni³, Ludovica Baldari³, Elisa Cassinotti³, Ronit Brodie¹ , Selman Uranues⁴, MinHua Zheng⁵ and Abe Fingerhut^{4,5} 

¹Department of General Surgery, Hadassah Hebrew University Medical Center, Jerusalem, Israel, ²Department of Surgical Sciences, University of Torino, Italy, ³Department of Surgery, Fondazione IRCCS – Ca' Granda,



Ospedale Maggiore Policlinico, University of Milan, Milan, Italy, ⁴Section for Surgical Research, Department of Surgery, Medical University of Graz, Austria, and ⁵Department of General Surgery, Ruijin Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai Minimally Invasive Surgery Center, Shanghai, 200025, P. R. China

DOI: 10.1002/bjs.11916

1 Pierce JS, Lacey SE, Lippert JF, Lopez R, Franke JE. Laser-generated air contaminants from medical laser

applications: a state-of-the-science review of exposure characterization, health effects, and control. *J Occup Environ Hyg* 2011; **8**: 447–466.

2 Royal College of Surgeons Urgent Intercollegiate General Surgery Guidance on COVID-19. <https://www.acpgbi.org.uk/news/urgent-intercollegiate-general-surgery-guidance-on-covid-19/>

3 American College of Surgeons (2020) COVID-19: Considerations for Optimum Surgeon Protection Before, During, and After Operation. <https://www.facs.org/covid-19/clinical-guidance/surgeon-protection>

4 Gattinoni L, Chiumello D, Rossi S. COVID-19 pneumonia: ARDS or not? *Crit Care* 2020; **24**: 154.

5 Mintz Y, Arezzo A, Boni L, Baldari L, Cassinotti E, Brodie R *et al*. The risk of COVID-19 transmission by laparoscopic smoke may be lower than for laparotomy: a narrative review. *Surg Endosc* 2020; **26**: 1–8.