

Review

How to Face with Minimally Invasive Abdominal Surgery During Covid-19 Outbreak? Surgical and Anesthesiological Concerns

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Abstract

COVID-19 outbreak has profoundly changed both management and schedule of surgical patients by reducing elective cases and reserving priority only to high-risk classes, such as oncological and emergency surgery. Notwithstanding the introduction of new protocols, evidences still claim debate and also surgical approaches, especially minimally invasive surgery, are currently being investigated as potential biohazard. Purpose of this article is to provide some clarifications and to envisage some recommendations aiming to minimize the theoretical risk of technical-related diffusion.

Keywords: Airway management, COVID-19, laparoscopy, minimally invasive surgery

Cite This Article: Barone M, Prioletta M, Guetti L, Capone S, Ghammachi LP, Ippoliti M, et al. How to Face with Minimally Invasive Abdominal Surgery During Covid-19 Outbreak? Surgical and Anesthesiological Concerns. EJMO 2020;4(3):181–184.

The need for surgical care for patients had to face the pandemic COVID-19 emergency, resulting in a non-urgent or non-cancerous cases reschedule with postponed reevaluation. However, in the setting of elective surgery, cancer patients remained priority and subjected to rigorous clinical, laboratory and historical assessments (individual exposure evaluation, microbiological swabs, chest x-ray/CT executions). Moreover, COVID-19 outbreak has hesitated into the recruitment and redistribution of consultants and specialists for dedicated Departments as well as into a substantial decrease in the no-nCoV intensive care beds availability in favour of extraordinary structural adjustments to cope with emergency. Therefore, the identification of dedicated centers and the creation of intraregional and national net-

works followed in order to define elective structures for nosocomial reception, albeit with several peculiarities and limits among countries dictated by pre-existing welfare networks and territorial support services.

Notwithstanding reduction in dedicated staff, hospital access has not undergone substantial changes for surgical pathways regardless the positivity or not for COVID-19, thus guaranteeing priority. However, concerns about both direct and indirect exposures remain central for both healthcare professionals and patients with a theoretical risk of fueling the onset of nosocomial infectious clusters, especially in case of asymptomaticity or paucisymptomaticity. This is preventable with the routine adoption of personal protection equipments (PPEs), the identification of isolated

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Submitted Date: April 02, 2020 **Accepted Date:** April 24, 2020 **Available Online Date:** April 28, 2020

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biohazard operative pathways, the adoption of structural restraints and dedicated services.

Further arguments still claiming debate arise about the possibility of indirect surgical exposures (airborne transmission) that could theoretically dictate both anesthesiological and surgical procedures (oro-tracheal intubation, traditional vs minimally invasive approach, the use of energy devices vs monopolar and bipolar electric generators). In fact, even if a coronavirus aerogenic transmission is recognized, little is known about its presence and its relative virulence index delivered by other means than droplets (blood, gastrointestinal liquid, cavity secretions, saliva).^[1] Although molecular assays have detected viral RNA in several biological specimens from nCOV patients, inconstant incidences seem to struggle with potential for viremic progression.

Wang et al.,^[2] reporting 1070 rRT-PCR *1ab* COVID-19 gene specimens collected from 205 patients, showed positivity in 29% of faeces and 1% of blood samples while no copies in urinary collections were found. However, haematogenous detection seems to be inconstant with rough prevalences ranging up to 10.5%.

Speculatively, therefore, it could be argued that COVID-19 syndrome, manifesting as a multiorgan viremia (coexistence of gastrointestinal, vascular, respiratory, cardiac and neurological symptoms),^[4] potentially makes each anesthesiological and surgical procedure at risk. The approach to any tissue would therefore be considered infectious and recommendations urge without disregarding factors such as virus microbiology, virionic penetrability index, replicability and host tissue interactions. In clinical practice, therefore, it would be faced with the preference of such strategies as well as with the remodulation of merely technical indications.

As reported by van Doremalen et al.,^[5] COVID-19 remains stable on stainless steel with virus availability up to 72 hours after application and a stability kinetics in the first two days similar to SARS coronavirus,^[6] thus any operating should be assumed contaminated and an effective source for virus widespread. In this setting, negative pressure environments (NPE) and continuous sanitations are recommended.^[7] NPE could prevent environmental suspension of aerosolized blood born viruses from energy device application or dissection manouevres. Although current data does not support any evidence about COVID-19, previous experiences with other viruses (Hepatitis B hepadnavirus, HIV retrovirus) have clearly demonstrated the aerosolization risk could be a biohazard for operating personnel. Baggish et al.^[8] reported HIV proviral DNA in cell vaporization, as far as Kwak et al.^[9] demonstrated sequences of HBV-DNA in smoke collections from patients undergoing minimally

invasive abdominal surgery. Nevertheless, erring on the struggle to face coronavirus and to ensure safety, it would warrant as exhibiting similar properties.

Functional airborne isolation cannot be separated from the patient's airway management where both anesthesiological induction and ventilation represent crucial aspects. Recently, the Italian Society of Anesthesia Analgesia Reanimation and Intensive Therapy (SIAARTI)^[10] released a statement in which the priority role of an integrated and systematic multidisciplinary management is stressed by primarily focusing on the importance of a trained team (also by means of simulations), on the availability of a suitable environment, on the adoption and rational use of second and third level PPEs and on checking clinical lists. To satisfy the aforementioned items, airway management cannot disregard the availability of closed section systems and the presence of airway protection barriers, avoiding as far as possible awake intubations and unnecessary disconnections or clampings. Similarly, the Anesthesia Patient Safety Foundation (APSF)^[11] suggested to avoid awake fibreoptic intubations, to adopt rapid sequence induction protocols in order to reduce patients' lung manual ventilation and potential aerosolization and to ensure the placement of high-quality heat and moisture exchanging filters. With regards nasogastric tube placement and its role as a aerosol generating procedure (AGP), data are conflicting although evidences could be quite simply reconciled by looking at specific circumstances in which NGT occurs, such as during abdominal surgery. Under ideal conditions, such as during general anesthesia, gastric detension devices are regarded non-aerosol generating procedures as no induced sneezing or coughing are caused. In this view, nasogastric tube placement could be risky only with conscious patients; but no evidences regarding COVID-19 transmission is reported to this date. But, referring to previous experiences during SARS outbreak, Tran et al.,^[12] reported insertion of nasogastric tube, in an operative setting, was not associated with an increased risk of virus transmission (pooled odds ratio: 1.2; 95%CI: 0.4-4.00).

Surgical approach may also raise concerns, especially in the current era of a progressive switch towards minimally invasive strategies both in elective and in emergency surgery. Despite some issues about laparoscopic surgery during coronavirus outbreak due to its peculiarity of an aerosol generating procedure, it is not clear if aerosolised carbon-dioxide solutions could convey virions during pneumoperitoneum. Li et al.,^[13] in a cohort study comparing the effects of laparoscopic and open abdominal surgery on the intra-operative concentration of microparticulate (PPM3-PPM5), reported a higher cumulative dose in minimally invasive approach rather than open prospecting an accumulation

effect with concentrated release of air suspensions. However, beyond any theoretical speculation, minimally invasive abdominal surgery presents two vulnerable aspects: tissue dissection with energy devices (favouring moment) and pneumoperitoneum resolution (dispersing moment). On the other hand, laparoscopy could reduce direct continuous exposure to smoke compared to an open system as being ideally a closed system; but, in daily clinical practice, air leakages around trocars during induction and maintenance are common. Risk management at the resolution of the pneumoperitoneum, however, could be solved by adopting closed circuit filters or water valves with protection systems.^[14]

Due to scarce experiences, rather monocentric or national ones, dissonant and fragmented indications emerge, supported by very small evidences. The unproven risks of nCOV viral transmission must, however, to be weighed against the well-known benefits in terms of morbidity and mortality, reduced hospital stay and early return to daily activities.^[15]

The Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) and the European Association of Endoscopic Surgery (EAES),^[16] in this setting, suggest a surveillance action for this purpose prior to state a unique position. Societies recognize the not negligible role of measures such as adopting personal protection devices, the setting up of dedicated environments and minimizing, as far as possible, human resources.

The microbiological *gray zone* as well as the relative frequency of new incoming evidences leads to the adoption of preventive technical strategies derived from experience on other viral infections, such as the minimization of electrosurgical dissectors and pneumoperitoneum pressures. It results into a statement with undefinitive and non-exclusive conclusions for the adoption of minimally invasive techniques in abdominal surgery, which is consistent with the Association of Italian Hospital Surgeons (ACOI) – Italian Society of Surgery (SIC) position.^[17]

Similar recommendations, giving the lack of strong evidences, are also provided by the European Society of Gynaecological Endoscopy (ESGE),^[18] albeit in a non-exhaustive manner and suggesting a relative contraindication to laparoscopy as *“there would be a risk to staff, increased beyond that for an open operation”*. In contrast, the British Society for Gynaecological Endoscopists (BSGE) support feasibility of laparoscopy.^[19]

The indications for minimally invasive abdominal surgery, therefore, appear rather influenced by the current pandemic issue, both in procedural terms and in material resources. In fact, the need for required environmental availabilities as

well as the recommendation for such instruments or devices could significantly interfere with the adoption of laparoscopic pathways instead of traditional open accesses, especially in peripheral realities or in spoke hospitals where the availability of resources is limited. But, the management of COVID-19 patients requires an intensive/subintensive multidisciplinary approach with specific resources usually present only in tertiary hospitals and this could translate into a sort of forced coexistence between the need for optimal management of the epidemic outbreak and the need to safely perform minimally invasive surgery. In this setting, a limit of the current hub-spoke models and their inapplicability in face of theoretical dedicated in-hospital isolation strategies would seem to emerge.

Furthermore, very-low grade available evidences do not discourage minimally invasive surgery. Although daily recommendation reviews, a laparoscopic approach cannot disregard three summary aspects (Fig. 1): environmental safety (healthworkers and structures), dedicated anaesthesiological procedures and surgical technical precautions.

Concerning these latter, priority should be given to checking an operating field with closed systems as far as checking tightness of the ports and avoiding high positive intra-peritoneal pressures. In a continuous filtering setting, the handling of viscera would appear safe avoiding the aerosolization of organic combustion products as well as exposure to theoretical direct vehicles of disease, such as blood or enteric material. Therefore, intracorporeal rather than extracorporeal visceral resections and anastomoses would be recommended.

Moreover, abdominal drainages should be discouraged, whenever possible, as they could carry two impelling risks both immediately (residual gaseous blow-out) and remotely (contact with intra-cavitary biological materials). Finally,

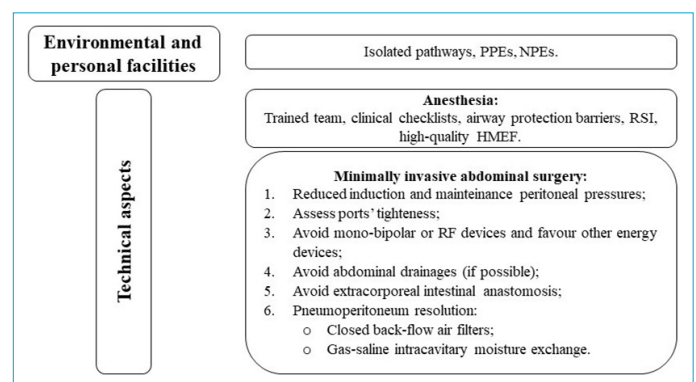


Figure 1. A pragmatic approach to minimally invasive abdominal surgery.

PPE: Personal Protective Equipment; NPE: Negative Pressure Environment; RSI: Rapid Sequence Intubation; HMEF: Heat and Moisture Exchanging Filters; RF: Radiofrequency.

meticulous attention should be paid to the reduction of pneumoperitoneum at the end of the procedure or during inadvertent conversions to open approaches. In particular, desufflation could take place through the application of closed gas filtering systems, the use of air-liquid barrier systems (translating the experience of some postoperative collection systems for thoracic surgery) or through methods of mixed gas-saline resolution into special hermetic suction devices (as occurs during intracavitary chemohyperthermias).

In conclusion, minimally invasive surgery, in the absence of further evidence, should not be opposed but rather revised in its technical peculiarities at the cost of a prolonged operating times, subsequently leading to a not negligible reduction in volume per day occupation rates.

Disclosures

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – M.B., S.C., M.P., L.G.; Supervision – C.L.L., S.M.M., F.M.; Materials – A.M., L.A., M.C., M.I.; Data collection &/or processing – M.B., S.C., M.P., G.C.; Analysis and/or interpretation – E.C., L.P.G., L.A.; Literature search – M.B., S.C., L.P.G., M.P.; Writing – M.B., M.P., L.G., S.C., L.P.G., M.I., E.C., M.C., A.M., G.C., L.A., I.D., C.L.L., S.M.M., F.M.; Critical review – M.B., M.P., L.G., S.C., L.P.G., M.I., E.C., M.C., A.M., G.C., L.A., I.D., C.L.L., S.M.M., F.M.

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