

Review Article

Practical approach for safe anesthesia in a COVID-19 patient scheduled for emergency laparotomy

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Abstract

COVID-19 patients presenting for emergency laparotomy require evaluation of surgical illness and viral disease. As these patients are likely to have a wide spectrum of deranged physiology and organ dysfunction, optimization should start preoperatively and continue through intraoperative and postoperative recovery periods along with appropriate antimicrobial cover. The goal should be not to delay damage control surgery in favor of evaluation and optimization. When a COVID-19 positive or suspected patient is to be operated for laparotomy, the situation often demands general anesthesia with invasive monitoring and analgesia complemented by regional anesthesia to minimize postoperative opioid requirements to facilitate early recovery. This particular article addresses the issues related to emergency laparotomy management in relation to COVID-19 patient. Healthcare workers should diligently use effective PPE and practice disinfection to prevent spread. Video-communication is an effective means of evaluation. Information expected from investigations should be weighed against risk of exposure to healthcare workers/laypersons. Simulation and memory aids should be used to familiarize team members with roles and techniques of management while in PPE. Step-wise detailed planning for patient transfer, anesthesia induction, maintenance and emergence, aid in enhancing HCW safety without compromising patient care.

Keywords: Anesthesia, COVID-19, laparotomy

Introduction

As the SARS-CoV-2 virus continues to infect humans across the globe, the incidence of COVID-19 patients presenting for emergency surgeries will inevitably increase. Emergent laparotomies comprise of a diverse group of surgical pathologies, frequently presenting in patients with attendant co-morbidities. This review highlights salient management principles for patients scheduled for emergency laparotomy^[1-3] along with outlining a practical, evidence-based approach on safeguarding healthcare workers (HCW) while managing such a patient with COVID-19 disease. Given the contagiousness of SARS-CoV-2 virus, limiting unnecessary/prolonged exposures of HCWs to patients is essential.^[4] These details are outlined in Table 1, Video 1. Since both COVID-19 and abdominal pathology requiring surgery can contribute to multi-organ dysfunction and derangement in patient

physiology, management should provide adequate weightage for both aspects.

Evaluation

The preoperative evaluation should be done with due protective precautions. History should focus on the duration and severity of COVID-19,^[5] etiology of the abdominal pathology along with associated co-morbidities [Table 1]. Meticulous chart review for on-going therapy for COVID-19 should be noted, in view of possible drug interactions.^[6] Individual organ system functioning should be assessed ideally with point of care technology e.g., Point of Care Ultrasound (POCUS), thromboelastogram (TEG), electrocardiogram (ECG), echocardiography (ECHO), chest X-ray (CXR), etc. where feasible with the goal of limiting patient movement out of the COVID facility. Further investigations should assess for sepsis, acid-base/electrolyte derangements, organ dysfunction and perfusion (serum lactate levels). Thoracic slices should be asked for whenever the patient is scheduled for abdominal high resolution contrast tomogram.^[7-10] Consent should include both concerns related to COVID-19 [Table 1] and the proposed surgery with anticipated outcome.

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Table 1: Preoperative patient care, evaluation, risk stratification and consent specifically in relation to COVID-19 status

Safety principles while conducting history and evaluation:

Telephonic conversation: History, present condition of the patient and investigation reports from the COVID ward resident doctor

In-house dedicated machines in the COVID ward: X-ray, electrocardiogram (ECG) and ultrasound with ECHO probe

Video call: Airway evaluation from resident doctor at COVID ward

Factors contributing to higher risk for worsening of the COVID-19 pathology:

Patient with advanced age (>60 years), associated co-morbidities such as cardiac disease, hypertension, chronic lung disease, diabetes mellitus, malignancy and immunosuppression

Surgical stress of laparotomy

Severity of associated organ dysfunction

Abnormal investigations relevant to COVID-19

Spread and extent of opacities on X-ray chest/Computed Tomogram
ECG or ECHO changes

Changes in the preoperative instructions specific to COVID-19 patients:

Metered dose inhalers instead of nebulizations for bronchospasm

Instruct deep breathing exercises from safe distance or video tutoring

Essential components of COVID-19 consent:

For patients:

Etiquette for safety of HCW to be followed stringently

COVID-19 pathology may worsen including mortality risk

Feeling of alienation in the operating room due to HCWs in PPE maintaining distance most of the times and claustrophobia due to presence of safety tent/aerosol box around the face

For healthcare workers:

In addition to possibility of contracting the virus, this may mean quarantine, loss of earning

Healthcare workers with age >60 years and associated co-morbidities should be aware of the added risk involved

Optimization

Emergency laparotomy is a time sensitive surgery where a bleeder/septic focus requires emergent damage control surgery. Delays in surgical damage control in favour of optimization are deleterious.^[1-3] Hence, the goal should be to judiciously optimize without delaying surgery and the extent of optimization should be determined by the surgical urgency. Hypovolemia is common due to dehydration, reduced intake, losses from drains/stomas, fever, redistribution of fluid between compartments, bleeding, retention in bowels, etc. Optimize fluid status with balanced salt solutions, initiate correction of dyselectrolytemia and acid-base disorders. Avoid colloids due to risk of exacerbation of coagulopathy and renal dysfunction. Life threatening bleeding should be managed by tranexamic acid, appropriate blood and blood product administration and withholding medications contributing to coagulopathy.^[1] Patients on chronic anticoagulant therapy should be switched to either bridging therapy with low molecular weight heparin or intravenous heparin. Patients at risk for significant lower limb venous thrombo-embolism can be managed with temporary

inferior vena cava filter insertion before withdrawing/reversing the anticoagulant effects.^[1]

In patients with sepsis/septic shock, rapid source control should be of the highest priority. Appropriate antibiotics should be administered at induction or at most within 60 minutes prior to incision. Distributive shock should be managed with goal-directed fluid management as well as judicious use of vasopressor infusions (norepinephrine, phenylephrine). Myocardial depression should be assessed with POCUS and managed with appropriate alteration of fluid and vasopressor therapy.

Diabetic patients should receive intravenous insulin infusion titrated for target blood sugar of 80-200 mg%. This should be continued till resumption of postoperative oral intake.

Patients with pre-existent medications for associated co-morbidities should be evaluated for the benefits versus risks of discontinuation for a few days. Where continuation is necessary, alternatives to oral route of administration should be explored. Avoid medications affecting renal function as perioperative acute kidney injury is highly probable in this group of patients.^[1]

Transport

One should ensure that the patient wears a mask and is placed inside a safety tent and shifted through a dedicated route to an operating room designated for COVID-19 patients [Video 2].^[11] While shifting a mechanically ventilated patient, precautions to prevent accidental extubation should be diligently taken, including sedation and paralysis. Mapleson C circuit or preferably a transport ventilator should be used with a High Efficiency Particulate Air (HEPA) filter or equivalent attached between the endotracheal tube (ETT) and the breathing apparatus. Decontamination of the route should be performed in tandem with passage of the patient trolley.

PPE

All HCWs involved in patient care should don full Personal Protective Equipment (PPE).^[12] Before donning PPE, the HCWs should hydrate themselves well, void, moisturize facial area under N₉₅ mask, and consider wearing a diaper in case of a long surgery. Inspect the PPE for defects before, during and immediately after donning. Labelling everyone's name and role on their PPE will aid identification since everyone looks alike. Closed loop communication, a board for written communication and rehearsal of steps of management with each team member till everyone clearly knows each other's roles and responsibilities, minimizes miscommunication.

Anesthesia plan

Monitoring

Monitoring of stable patients who are unlikely to deteriorate should include ECG, pulse oximeter (SpO₂), waveform capnogram (ETCO₂), non-invasive blood pressure, temperature, peripheral nerve stimulator, urine output and blood loss. For other patients and for patients with intraoperative instability, optimal management would depend upon integrating the fluid status, myocardial activity and tissue perfusion. Hence, consider individualized Point of Care (POC) monitors for goal-directed fluid therapy for achieving better hemodynamic control, tissue perfusion and optimizing altered coagulation (POCUS, arterial blood gas with electrolytes, TEG). Additionally, glucometer should be used for optimizing the blood sugar in diabetic patients. Invasive monitoring may be initiated based on the hemodynamic stability.^[1-3]

Regional technique

While planning regional techniques, due considerations should be given to COVID-19 precautions and coagulopathy [Table 2].^[13-15] Regional techniques may include insertion of low thoracic epidural catheter (pre-induction) or bilateral transversus abdominis plane/posterior rectus sheath block (post-induction or prior to extubation). Goal should be to minimize postoperative opioid use to facilitate early recovery and ambulation. Hence, where regional techniques are not feasible, non-conventional methods for pain relief such as intravenous infusions of lidocaine, ketamine, or MgSO₄ may be considered as alternatives to opioids.^[2]

General anesthesia (GA)

Due to propensity of these patients for aspiration of gastric contents and postoperative pulmonary complications (PPC), rapid sequence induction and intubation (RSII) using cuffed ETT with supraglottic suction facility should be planned along with precautions for COVID-19 [Video 3].^[16-20] The gastric tube should be drained before induction. Judiciously choose induction agents based on the hemodynamic status and neuromuscular blocker to facilitate rapid onset of action. A plan for unanticipated difficult airway should be discussed and displayed in the operating room [Table 3].

Maintenance

In view of higher propensity for development of acute lung injury in these patients, protective lung ventilation strategy should be used along with avoidance of permissive hypercapnia if the patient already has pre-existent metabolic acidosis.^[2] Maintenance of anesthesia can be with volatile anesthetics in oxygen and air or with total intravenous anesthesia (TIVA). One should be aware that TIVA increases the number of fomites in the theatre. Optimization of patient status should be extended to maintenance phase as well as postoperative period. Specific care should be taken to prevent development of hypothermia.

Extubation

Patients often require intensive care unit (ICU) management for (a) continued optimization, (b) for respiratory or renal support, (c) hemodynamic instability, or (d) distended abdomen. Therefore, extubation should be considered only after acceptable optimization of acid-base, electrolyte and temperature disturbances, hemodynamic stability and after ensuring awake patient with intact protective airway reflexes. Extubation should be performed within the safety tent after gastric and oropharyngeal suctioning as per protocol for COVID-19 patients [Videos 4 and 5].^[18,21] In view of COVID-19 status, patients extubated on table, should be observed for stability (20 min period mandatory after aerosol generating procedure) there itself before shifting to COVID facility. Others should be shifted to COVID ICU with due precautions while shifting out as during shifting in. Personnel shifting the patient out should don fresh PPE.

Operating room decontamination and doffing

After the patient is shifted out, appropriately discard disposables into assigned bins; use double zip-lock bags for recyclables and send for decontamination and sterilization. Finally, decontamination and disinfection of the operating room should be carried out as per protocol.^[22,23] Doffing should be carried out in dedicated area as per protocol.^[12]

Postoperative considerations

Wards receiving postoperative COVID patients should be equipped to provide adequate monitoring. Benefits of early mobilisation (improved respiratory function, early resolution of

Table 2: Principles of regional techniques for pain relief

Avoid if pain relief can adequately be managed by systemic analgesics
Preferably avoid techniques close to patient airway in favor of others
Prefer techniques that can be performed after securing trachea
Rationalize plan based on coagulation profile of the patient (avoid central neuraxial block if platelet count <70,000 or significantly altered coagulation profile)
Prefer techniques that do not require patient re-positioning under anesthesia to minimize circuit disconnections
Preferably perform under ultrasound guidance for optimal results to avoid conversion to general anesthesia

Table 3: Plan for unanticipated difficult airway

Plan A: modified rapid sequence induction and intubation (RSII)
Plan B (failed intubation): Second generation supraglottic airway (SGA) or attempt awakening the patient (if succinylcholine used) with low tidal volume bag mask ventilation (BMV). If SGA inserted, consider awakening the patient or carrying out intubation through the SGA [preferably guided by fiberoptic > lightwand > bougie > tactile/blind]. If patient awakened, decide on re-intubation or awake tracheostomy after involving senior help.
Plan C (cannot intubate, cannot oxygenate): Emergency cricothyrotomy with scalpel, bougie, finger, twist technique.

ileus, prevention of deep vein thrombosis) potentially outweigh the risk (requirement of HCWs to stay in close proximity of patient). Active chest physiotherapy, deep breathing exercises and early ambulation will minimize PPCs.^[2] Continuation of goal-directed therapy with optimal analgesia, fluid management, early mobilization and optimization of nutrition will aid in postoperative recovery,^[24] though a laparotomy patient who is COVID positive is likely to have a stormy postoperative course, as viral illness is known to worsen subsequent to reduction in cell-mediated immunity caused by surgical stress.^[5] Removal of the epidural catheter should be done when platelet count and coagulation status are acceptable with due considerations to anticoagulants administered in the postoperative period. Deep venous thrombosis (DVT) risk can be minimized mainly by early postoperative ambulation along with appropriate non-pharmacological and pharmacological measures to prevent DVT till initiation of ambulation.

Conclusions

The challenges routinely faced by anesthesiologists during emergency laparotomies are increased manifold if the patient is COVID positive. The contagiousness of SARS-CoV-2 makes it imperative that the health of the HCW is safeguarded without compromising on the quality of patient care. This is possible when all stake holders are familiar with relevant evidence-based protocols, and diligently adhere to them. The goals of emergency laparotomy management such as early damage control surgery, appropriate antimicrobial cover, goal directed fluid therapy, protective lung ventilation, early postoperative ambulation should be stringently adhered to, in order to minimize morbidity and mortality.

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Conflicts of interest

There are no conflicts of interest.

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