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My Thoughts/My Surgical Practice

Surgery during the COVID-19 pandemic: A comprehensive overview and perioperative care



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Introduction

In late December 2019, outbreak pneumonia of unknown cause occurred in Wuhan, Hubei Province, China.¹ The underlying causative agent of this pneumonia was identified as a novel coronavirus, that was initially named as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the disease related to it as coronavirus disease 2019 (COVID-19) by the World Health Organization. Later on, The World Health Organization (WHO) named this pathogenic virus for 2019-nCoV.^{2,3} The pathogenic virus is a member of a large group of highly diverse viruses called coronaviruses, it is an enveloped virus that is composed of a positive-sense single-stranded RNA as its genetic material.⁴ On March 11, 2020, WHO has declared COVID-19 as pandemic disease and by March 26, 2020, COVID-19 has spread to nearly 199 countries and territories worldwide with more than 462680 cases and approximately 20834 deaths.⁵ So far, 2019-nCoV is the seventh member of the family of coronaviruses that infects humans. In the last two decades, two epidemic severe human diseases have emerged and they were attributed to two novel coronaviruses, severe acute respiratory syndrome CoV (SARS-CoV) and Middle East respiratory syndrome CoV (MERS-CoV). Respectively; both viruses have infected more than 8000 and 857 cases worldwide with mortality rates around 10% and 35%.⁵

Disease transmission

Early reports suggest that 2019-nCoV (SARS-CoV-2) is likely originated in bats, while the intermediate host between bat reservoir and human is still unclear.^{6,7} Human to human transmission of COVID-19 is mainly by droplet and or close contact between

affected person and healthy one.⁸ Although the virus has been identified in tears and stool of diseased person, disease transmission through the oral, fecal or conjunctival routes is unknown.^{9,10,19}

The disease is highly contagious, even it is too early to identify the accurate reproductive number (R0) (i.e. patient's capability to spread the disease to people in contact), some studies have estimated the mean R0 in a range of 2.20–3.58. This means that each patient has been spreading the infection to 2 or 3 other people.^{11,12}

Clinical presentation

The incubation period for the virus reaches up to 14 days with a mean duration of 5.2 days, one asymptomatic carrier reported with an incubation period of 19 days, and almost all patients are likely to experience one or more symptoms within 12.5 days of contact.^{11,13,14}

Patients with COVID-19 can be asymptomatic carriers or they might develop symptoms ranging from mild symptoms up to respiratory or multiorgan failure. Patients mainly present with fever, dry cough, myalgia, fatigue, and dyspnea. Less common symptoms include diarrhea, abdominal pain, dizziness, productive cough, pleuritic chest pain and hemoptysis.^{11,15–17}

According to Diagnosis and Treatment Protocol for Novel Coronavirus Pneumonia (Trial Version 6) that was released by the National Health Commission & State Administration of Traditional Chinese Medicine, patients can be classified into four categories (i.e. mild, moderate, severe and critical). Patients in the mild group have mild symptoms with no radiologic findings of pneumonia. Moderate cases Show fever and respiratory symptoms with radiological findings of pneumonia. Severely diseased patients have dyspnea, tachypnea (i.e. respiratory rate ≥ 30 /min), hypoxemia (i.e. blood oxygen saturation $\leq 93\%$) and lung infiltrates $>50\%$ within 24–48 h. Critically ill patients have septic shock, respiratory failure or multiorgan dysfunction.¹⁷ Although it is early to estimate COVID-19 mortality rates, at the time of editing this article, reported figures showed a global mortality rate of 4.49%.

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Clinical diagnosis

In the early course of the disease, WBC count may be normal. Common laboratory findings in patients with COVID-19 include leucopenia, lymphopenia. Some patients have an elevated lactate dehydrogenase, creatinine kinase, alanine aminotransferase, and aspartate aminotransferase. Lymphopenia is considered a cardinal feature of this disease. Approximately 30% of patients had an abnormally elevated D-Dimer level. Even serum levels of procalcitonin were normal in most patients, the C-reactive protein was elevated.^{4,11,14}

Computed tomography (CT) imaging of the chest in patients with COVID-19 has characteristic manifestations related to different clinical types of the disease (i.e. mild, moderate, severe and critical). There were no abnormal CT findings in mild cases. Moderate cases are mainly manifested as solid plaque shadow and halo sign (i.e. ground glass opacity surrounding a pulmonary nodule or mass); these changes have been identified in 91% of cases. Severe cases show fibrous strip shadow with ground glass changes; multiple lesions documented in more than 95% of cases. Consolidation shadow as the main lesion is the main finding in critically ill patients.¹⁸

Detection of viral RNA using real-time reverse transcriptase-polymerase chain reaction (rRT-PCR) is used to confirm the clinical diagnosis. For the most sensitive detection of 2019-nCoV, the collection and testing of both upper and lower respiratory samples are recommended. Bronchoalveolar lavage fluid specimens have the highest positive rates 93%, followed by sputum 72%. Nasal swabs, fiber bronchoscope brush biopsy, and pharyngeal swabs detection rates are 63%, 46%, and 32%. Both fecal and blood specimens have positive rates in only 29% and 1% of diseased patients. Regardless the high detection rates in bronchoalveolar lavage fluid and sputum, The US CDC recommends collecting only the upper respiratory nasopharyngeal (NP) swab because of the increase in biosafety risk to healthcare workers through the creation of aerosol droplets.^{19–21}

Preadmission and admission considerations in COVID-19 pandemic

All patients who are eligible for operative intervention need to be categorized into three groups based on the possibility of having a 2019-nCoV infection (i.e. non-infected people, asymptomatic carriers and symptomatic patients). Preadmission history regarding patient's general condition, presence of active or recent respiratory or gastrointestinal symptoms, anosmia, history of recent travel to an endemic country in the last 14 days or history of contact with a person at risk to have the 2019-nCoV infection should be evaluated properly.

It is recommended that all surgery patients must complete preoperative health screening despite being asymptomatic.²⁷ Regardless of patient status of infection; it is recommended that all elective surgeries to be postponed knowing the fact that hospitals are rapidly becoming hot zones for treatment and transmission of this disease.^{22,26}

All suspected patients or symptomatic patients need to be evaluated carefully to confirm the diagnosis of COVID-19 disease. If the diagnosis is confirmed, the patient should be quarantined and reported to the national authorities. On the other hand, patients who are non-suspected or proved to be disease-free should be admitted into single rooms to prevent hospitalized patients from incubating in 2019-nCoV infection or asymptomatic 2019-nCoV

infection, and prevent the possibility of cross-infection with people in contact.²²

In cases of emergent and life-threatening conditions where PCR is not available, all patients should be presumed diseased and approached similarly to infected patients.²⁹ All preoperative, intraoperative and postoperative measures should be taken into consideration until the diagnosis is confirmed or the patient is discharged.

Perioperative measures in COVID-19 patients

Preoperative considerations

All medical staff should be performing their clinical tasks wearing gloves, hats, and disposable surgical masks correctly. Whenever a suspected patient or a COVID-19 diseased patient is encountered, extra precautions should be taken to keep protection at a high level. If this the case, all providers should utilize personal protective equipment (PPE) including fit-tested disposable N95 respirator, goggles, face shield, gowns, double-layered gloves, and protective footwear to achieve maximum droplet/contact isolation precautions.^{22,23,29} Medical staff should complete personal hand hygiene before and after contact with patients and after removing gloves.^{22,23,26}

As Medical staff has extensive contact with patients and their families as well as other health care providers, they are very likely to cause cross-infection. Because of that, the daily assessment of personnel health status and recording body temperature should be implemented. Any medical staff with an increase in his body temperature should be isolated and investigated for the possibility of acquiring the disease.²²

Properly protected anesthetists need to oxygenate patients with 100% O₂ for 3–5 min then to perform rapid sequence induction and intubation to avoid manual ventilation and decrease the possibility of aerosolization of virus from airways.³⁰ Once PPE is removed proper handwashing before touching the surrounding environment. It is recommended to use a high-quality HMEF (Heat and Moisture Exchange Filter) between the facemask and breathing circuit. It is estimated that HMEF can remove 99.97% of airborne particles equal to or greater than 0.3 microns.^{24,30} Anesthetic equipment must be used by one person only as well as the anesthesia machine is strictly disinfected according to requirements after use.²⁴

Intraoperative considerations

If a patient is having COVID-19 disease or even highly suspected, the operation should be performed in a designated negative pressure environment²⁶; it is essential to keep pressure difference between the operating room below - 4.7 Pa.²⁹ Medical staff should be reduced as much as possible as well as their temperature needs to be measured before starting the surgery.

Surgeons and adjunct medical staff should be aware of blood and body secretions at the time of surgery, all equipment should be kept clean of these secretions.²⁷ Aerosol generating procedures (AGPs) are associated with an increased risk to the health care providers. AGPs include and not limited to intubation, extubation, chest tube insertion, bronchoscopy, bag masking, gastrointestinal endoscopy, laparoscopy and the use of energy devices (e.g. electrocautery). When using electrocautery or other energy devices in surgery, adjust to the lowest effective power possible to reduce the amount of surgical smoke, and use a smoking evacuator.^{22,27}

The choice between laparoscopy and laparotomy as a surgical approach needs to be cautious. As the use of laparoscopy was proved to have advantages, patients with good cardiopulmonary function and general condition can be considered for laparoscopic surgery. Careful attention during pneumoperitoneum creation and strict aerosol management must be made even during the operation.^{22,27} In response to artificial pneumoperitoneum, there will be a reduction in lung volume, increased airway pressure, increase CO2 retention, and decreased lung compliance. Therefore, the risk of perioperative infection 2019-nCoV is considered high.²⁸ To minimize the impact of pneumoperitoneum on lung function, circulation and susceptibility for pathogen infection, both intraoperative pneumoperitoneum pressure, and CO2 ventilation should be at the lowest possible. Surgical smoke and pneumoperitoneum should be evacuated only using a direct suction connected to a vacuum suction unit.²⁷

Postoperative considerations

Postoperatively, specimens should be labeled as 2019-nCoV and handled as infectious specimens for treatment with the pathology department. Disease-free patients can be transferred to the regular surgical ward for their postoperative management. Daily assessment of body temperature as well as respiratory symptoms is mandatory.²² Any patient with new-onset fever or cough should be isolated and investigated thoroughly to rule out 2019-nCoV infection.²⁵ Suspected or confirmed patients should be isolated in a single room with a negative pressure, sufficient oxygen supply and nebulization should be considered. Postoperative rounds, medications and wound management should be performed under personal protection to avoid contact with secretions. In case of suspected COVID-19, all medical staff should be isolated and quarantined for observation until the patient is cleared. If the diagnosis of COVID-19 is confirmed or was previously identified, the medical staff involved in the surgery need to be isolated for 14 days after the surgery.²²

Conclusion

In the era of COVID-19 pandemic, all health care providers must implement standardized essential perioperative measures including the use of PPEs to control disease transmission, and avoid unwanted complications. In life saving procedures, all patients need to be managed as COVID-19 patients until results are confirmed. Elective procedures are recommended to be postponed and to consider only urgent, lifesaving procedures and oncologic surgeries that are associated with worse outcome if delayed. The use of laparoscopy is still considered valid option talking in consideration extra precaution during creation of pneumoperitoneum, cardiopulmonary physiology and gas deflation.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

There are no conflicts of interest to declare.

Acknowledgments

free.

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