



ANAESTHETIST AND INTENSIVIST AS A COVID-19 WARRIOR IN THE HIGH DEPENDANCY AND INTENSIVE CARE UNIT

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ABSTRACT

Coronavirus are group of related viruses causing respiratory disease and is the seventh virus known to infect humans. A smaller proportion of individuals develop the chronic respiratory illness necessitating treatment in the intensive care requiring non invasive or invasive ventilation. Long COVID syndrome is characterized by severe fatigue, myalgia, joint pain, feeling of heat or cold, low grade fever, sweating, insomnia, dry cough, anaemia and lymphadenopathy. Cardio pulmonary resuscitation involves a series of events which favours the risk of aerosol generation including suctioning, mask ventilation and endotracheal intubation.

Key words:

COVID-19, Anaesthetist, Intensivist, critical care, high dependancy

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INTRODUCTION

Coronavirus are group of related viruses causing respiratory disease and the infections in humans vary from milder to lethal form. China notified WHO regarding Severe acute respiratory syndrome corona virus (SARS-CoV-2) on 31st December 2019¹; and first case reported in US was at seattle on 15th January 2020. SARS-CoV-2 is the seventh corona virus known to infect humans and was declared a global pandemic by WHO on 11th March 2020 and national emergency set on 12th March 2020².

Epidemiology

COVID-19, as sRNAvirusspreads infections to community through bats or pangolins to human beings by respiratory droplets from asymptomatic carriers³. Faeco-oral route of transmission is also reported in fewer cases. The new corona virus can live on all the surfaces like paper, tissue paper, copper, cardboard, wood, cloth, stainless steel, plastic and glass for few hours to several days. The incubation period is about 4 to 14 days and a smaller proportion of individuals develop the chronic respiratory illness necessitating treatment in the intensive care requiring non invasive or invasive ventilation⁴. Case fatality rate is about 0.25 to 3%⁵.

Clinical presentation and management

The common clinical presentation are cough in 65-80%, 45% febrile at presentation and 85% febrile during illness, 20-40% present with difficulty in breathing, 15% upper respiratory tract infections and 10% upper abdominal symptoms.

Cough

Maintaining the cough hygiene is an important tool in COVID19. To minimize the risk of cross transmission cover the nose and mouth with a disposable tissue when sneezing, coughing, wiping and blowing the nose; and clean hands with soap and water, alcohol hand rub or hand wipes after coughing, sneezing or after contact with respiratory secretions or objects contaminated by these secretions. Nonpharmacological measures includes avoiding smoking, encouraging of plenty of oral fluids, honey and lemon in warm water and elevating the head while sleeping. Pharmacological measures includes simple linctus codeine, Morphine sulphate, sodium chromoglycate (oral, inhalational, subcutaneous or intravenous)

Breathlessness

Difficulty in breathing is commonly encountered in most of the cases and is directly related to the severity of the illness. Non Pharmacological measures includes proper positioning in patients (Sit upright, leg as uncrossed, let shoulders droop,

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keep head up, lean forward), reducing room temperature and cooling the face by using a cool flannel or cloth.

Portable fans used in the clinical areas have been linked to cross infection in healthcare and social care facilities, although there is no strong evidence yet. Portable fans are not recommended for use during outbreaks of infection or when a patient is known or suspected to have an infectious agent⁴. Pharmacological measures include supplemental oxygen (No evidence of benefit in the absence of hypoxaemia) and Opioids may reduce the perception of breathlessness by the use of Morphine (oral, intravenous or modified release tablets), Midazolam and Lorazepam.

Fever

Significant fever is defined as a body temperature of 37.5° C or greater (oral), 37.2° C or greater (axillary), 37.8° C or greater (tympanic) and 38° C or greater (rectal). Associated signs and symptoms include shivering, shaking, chills, aching muscles and joints and other body aches. The nonpharmacological measures include reducing room temperature, wearing loose clothes, cooling the face by using a cool flannel or cloth and encouraging adequate oral fluids. Pharmacological measures include Paracetamol supplemented through oral and intravenous routes and NSAIDs are contraindicated. There is still controversy in supplementing Paracetamol starting with 40 mg and can be stepped up to 80 – 100 mg.

Pain

Pain is an important tool and an essential management component in any of the diseased state. The pain modality can be treated either with oral opioids or combination of drugs and intravenous route when the oral routes fail to alleviate the pain. Initially it is advisable to check effectiveness of the dose of opioid and titration depends upon the outcome of the pain relief and the side effects. The various drug modalities in the management of pain are Paracetamol, Codeine and Morphine in the form of oral, rectal, subcutaneous, transdermal, intravenous or sustained release tablets³. Care must be taken to prescribe a laxative and an antiemetic along with the stronger opioids.

Prevention of delirium is better than cure, so meticulous adherence to delirium prevention strategies (orientation, prevention of constipation, management of hypoxia) is essential. Adoption of daily screening, using single question in delirium (SQiD) and or 4AT Rapid test for delirium to detect and treat the cause. Non pharmacological measures include identifying and to manage underlying cause or combination of causes, ensure effective communication and reorientation (for example explaining where the person is, who they are, and what your role is), ensure adequate lighting and to provide reassurance for people diagnosed with delirium. Pharmacological measures such as Haloperidol, Midazolam, Lorazepam and Levomepromazine are used in incremental doses or in aliquots by oral or intravenous route⁵.

Long COVID syndrome is characterized by severe fatigue, myalgia, joint pain, feeling of heat or cold, low grade fever, sweating, insomnia, dry cough, anaemia and lymphadenopathy. Recovery from COVID is defined as complete resolution of symptoms without any fever for 24 hours by 10 days from the onset of symptoms or 20 days for severe illness, with 2 negative RT PCR test with antibody test⁶. Persistent viraemia or reactivation after clinical recovery is common in patients who were started on steroid early in the disease, those who had a stormy pulmonary course, immune compromised individuals, immunosuppressed, post transplant, malignancy or chemotherapy. RT PCR remains positive for up to 3 months-inactive viral particles where the replication is incompetent and isolation of culturable virus indicates viremia.

Post COVID pulmonary fibrosis is a normal process in a healing cascade and the incidence is about 80% if there was a preceding cytokine storm, 65% patients in patients who required early mechanical ventilation and 20 to 30% patients who recovered uneventfully. Clinically manifested with late dyspnea on exertion or chest tightness where all the vital capacity maneuvers will be impaired with persistent desaturation and about 70% patients will recover within 3 months⁷.

Table 1 Recommended Drug Modality in COVID-19 patients⁸

Drug Name	Category	Mechanism of action	Indications	Route of Administration
Remdesivir	Antiviral	Speeds recovery by shutting down viral replication in the body	In patients with worsening of imaging studies and cytokine storm	Intravenous Inhaler
Glucocorticoids	Corticosteroid	Calms acute inflammatory response to slow disease progression by preventing the body from pumping out inflammatory chemicals	In patients with progressive deterioration of oxygenation indicators, rapid worsening of imaging and cytokine storm	Intravenous
Favipiravir	Antiviral	Selectively inhibits RNA polymerase needed for the replication of SARS-CoV-2 inside the human body to cause severe disease	For mild to moderate disease	Oral
Dexamethasone	Corticosteroid	Modulates immune mediated lung injury and slow progression to respiratory failure and death	In severely ill patients on invasive ventilation or oxygenation	Intravenous Oral
Tocilizumab	Monoclonal antibody	Calms the aberrant hyper immune response, cytokine storm by acting against inflammatory chemicals to fight infection	Moderate to severe disease	Intravenous
Hydroxy Chloroquine	Antimalarial	Found to inhibit the activity of SARS-CoV-2 in lab studies by decreasing the acidity in endosomes	Prophylaxis for high risk close contacts, health care workers and frontline workers who have had unprotected exposure to infection	Oral
Convalescent Plasma	Plasma therapy	Infection fighting antibodies from the blood of recovered people given to all patients to boost their immunity	For patients with moderate disease whose oxygen requirements is progressively increasing despite the use of steroids	Intravenous transfusion

Delirium

	Incubation	Prodromal	Pneumonia	Immunological
PHYSIOLOGY CLINICAL STATUS PHASES		- Fever - Cough - Sore throat - Arthralgia, Myalgia - GI (diarrhoea, vomiting, abdominal pain)	- Fever (recurrent or persistent) - Lethargy - ↑CRP, ↑ALC - CXR features of pneumonia	- Hypoxia or progressive exertional dyspnoea or shortness of breath - ↑CRP, ↑ALC - ↑TR, ↓SpO2
	Most patient will be in this stage and do not progress into pneumonia phase		Clinical deterioration	Most mortality in this phase
MANAGEMENT	Nasopharyngeal Replication 3-14 days (median 5 days) Contact tracing Isolation Observation	Nasopharyngeal replication, binding to ACE2 receptors (lungs, liver) Day 1 - Day 7 Observation Hydroxychloroquine OR Chloroquine	Day 8 - Day 10 Hydroxychloroquine If progressive, add: Lopinavir/Ritonavir (Kaletra)	Cytokine storm (Interleukins + TH2) Hydroxychloroquine/Chloroquine + Lopinavir/Ritonavir (Kaletra) + Ribavirin / Interferon Beta-1b + Immunomodulators (eg. steroids/IVIg/Tocilizumab)
CATEGORY	1. Asymptomatic	2. Symptomatic but no evidence of pneumonia	3. Pneumonia	4. Pneumonia with hypoxia 5. Critically-ill with shock/MOF/ARDS

Figure 1 Clinical Progression and Proposed Management

Histopathological changes in the lungs of a COVID patient includes hyaline membrane formation, desquamation of pneumocytes, fibrin deposits in lungs, inflammation with mononuclear cells and diffuse alveolar damage.

Impact of drugs used for COVID

1. Hydroxychloroquine-Have long half life, all anaesthetic agents have potential to prolong QT interval and increased risk of nausea and vomiting
2. Flavipiravir and Remdesivir-produces liver function derangement, nausea and vomiting
3. Tocilizumab-Produces prolonged immunosuppression and secondary infection, hypercholesteremia and liver dysfunction
4. Steroid therapy-Severe insulin resistance, Hyperglycaemia and persistent adrenocortical suppression
5. Oxygen therapy-Lorraine smith effect and Paul bert effects

Laboratory investigations

The commonest blood reports seen in COVID-19 patients are Leucopenia and lymphopenia (80%), mild thrombocytopenia, elevated Urea, creatinine Alanine transaminase, aspartate Aminotransferase, bilirubin, lactate dehydrogenase, D-dimer, C-reactive protein, troponin I, hypofibrinogenemia, Interleukin-6, ferritin, decreased Procalcitonin levels and positive RT-PCR test⁹.

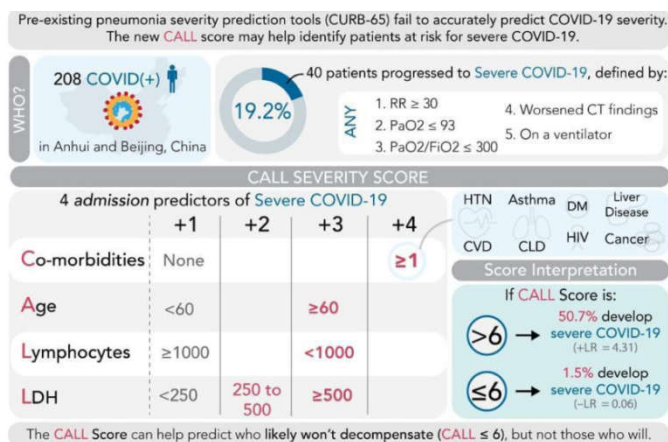


Figure 2 Predicting deterioration of COVID-19 (Call Severity Score)¹⁰

Imaging studies

CXR – Hazy bilateral peripheral opacities
 CT Chest – Ground Glass opacities, crazy paving, consolidation, can be unilateral rarely
 POCUS– Numerous B lines, pleural line thickening, consolidations with air bronchogram

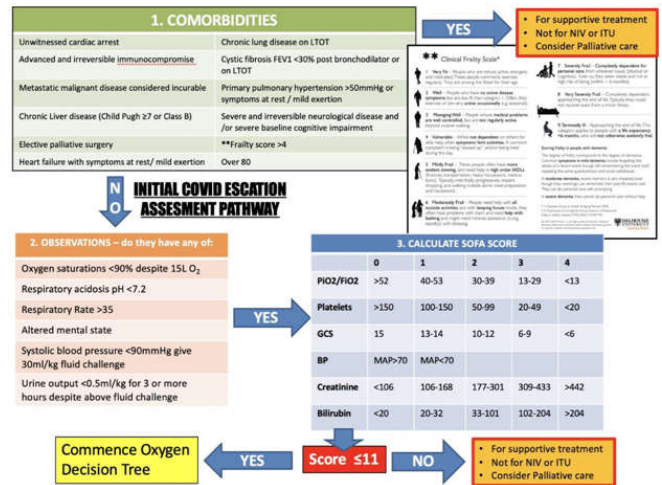


Figure 3 SOFA Score

Preventive measures

The important steps for preventing the transmission of coronavirus in the critical care area includes diligent hand washing, particularly after touching any surfaces, use of hand sanitizer that contains at least 60% alcohol, respiratory hygiene by covering while coughing or sneezing, use of triple layered surgical mask, avoiding crowds if possible especially in poor ventilated spaces, avoiding close contacts with ill individuals, maintaining a social distancing of at least one metre, can use pen for switching of lights in common areas, lift buttons, avoid keeping patients files on the beds and most importantly the used mask and other personal protective equipments should be considered as a potentially infected material and should be disposed separately in an infectious waste disposal bag.

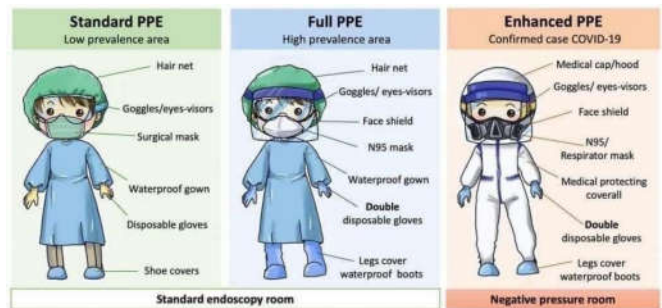


Figure 4 Personal Protection Kit

General and Ventilator principles in ICU care^{11,12}

The various management of covid patients in intensive care depends on the severity of the disease. The general principles involved in intensive care unit includes:

- ICUs should be equipped with negative and positive pressure regulations, an alternative approach is using HEPA-Carbon-Photocatalysis air purification systems as alternate means of source control
- Liberal fluid administration should be avoided for risk of worsening oxygenation and periodic hemodynamic assessment used to guide goal-directed therapy
- Adequate nutritional support with balanced proportions of proteins, carbohydrates, vitamins and minerals boosts immunity to fight the infection
- Empirical antimicrobials must be given within one hour based on the clinical diagnosis, local epidemiology and susceptibility data to cover all likely pathogens causing

community acquired pneumonia even if suspected to have COVID

- Post tracheal intubation by rapid sequence intubation, lung protective strategies involving use of lower tidal volumes (4–8 ml/kg predicted body weight), high PEEP and lower inspiratory pressures (plateau pressure <30 cmH2O) for meeting the pH goal of 7.30-7.45 have been postulated to prevent volutrauma, barotraumas andatelectotrauma
- High flow nasal oxygen is generally not recommended in view of risks of depleting oxygen reserve stores in hospital and escalation in appropriate treatment of tracheal intubation; similarly low flow nasal oxygen is not recommended in case of ease of tracheal intubation victims considering the apnoea time being safer¹³
- Deep sedation with Midazolam, Propofol or Fentanyl infusions are recommended to curb the patients’s respiratory drive and prevent dyssynchrony. In fulminating caes, prone ventilation for 12-18 hours per day is useful
- Meticulous preoxygenation, rapid sequence intubation, use of waveform quantitative capnography is mandatory during intubation
- Closed tracheal suctioning is mandatory
- Separate area for donning and doffing

Indications for mechanical ventilation¹⁴

- Refractory hypoxemia
- Respiratory failure
- Sepsis with multi organ dysfunction
- Inability to maintain on non invasive ventilation

Indications for ECMO¹³

- Potentially reversible severe respiratory failure
- Murray lung injury score ≥ 3
- Failed trial of ventilation in prone positioning ≥6hours
- Failed optimal respiratory management / lung protective ventilation
- Clinical frail scale category ≤ 3

Best practice recommendations (SOPs) for airway management in patient with suspected corona viruses^{11,12,13,15,16,17}

Aerosol intubation chamber

The aerosol box protects the healthcare workers during the procedures that are performed with this chamber in suspected or confirmed cases of COVID-19 like endotracheal intubation, throat swab, diagnostic bronchoalveolar lavage and videolaryngoscopy. The box works by sitting over the head and shoulders of a patient; and act as a protective shield between the patient and doctors avoiding the particulate to go right up in the air or on the face of the performer avoiding the spread of covid-19. The disinfection of the intubation chamber are done by cleaning with soap water followed by 1% sodium hypochlorite solution or surgical spirit or alcohol based disinfectant solution (>65% solution). Handling should be cautious to avoid using corrosive acids for cleaning and gentle cleaning must be done with cotton / soft cloth to avoid scratches in acrylic.

The specifications of this aerosol intubation chamber are

- Transparent acrylic sheet over top
- Semi transparent polycarbonate sheet over sides and head end

- Polycarbonate is used to make it weightless (≈ 2.6 to 2.8 kg)
- Aluminium support in edges to avoid damage during handling
- Silicone gel sealant over edges
- Suction ports may be kept inside chamber to create negative pressure
- Disposable / cotton sheet may be covered over front side
- Optional attachment for disposable / reusable rubber gloves

Predictors of independent risk factors for poor clinical outcome in COVID-19 includes

- Age of the individual
- Comorbidities like DM, COPD, CVD
- SOFA score during admission
- Laboratory findings like increased d-dimer, ferritin, troponin and cardiac myoglobin
- Prolonged mechanical ventilation in ICU stay

Vaccines under trial includes

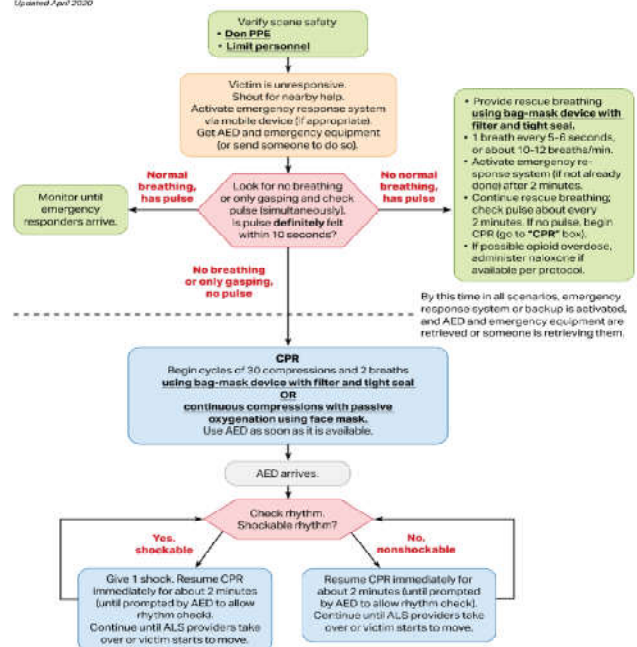
- Altimmune’s intranasal corona virus vaccine
- INO-4800 by Inovio pharmaceuticals
- mRNA-1273 vaccine by Moderna
- Avian corona virus Infectious Bronchitis Virus (IBV) vaccine by MIGAL
- All vaccines are in developing stage only

Special Circumstances

Modifications on CPR

Cardio pulmonary resuscitation involves a series of events which favours the risk of aerosol generation including suctioning, mask ventilation and endotracheal intubation.

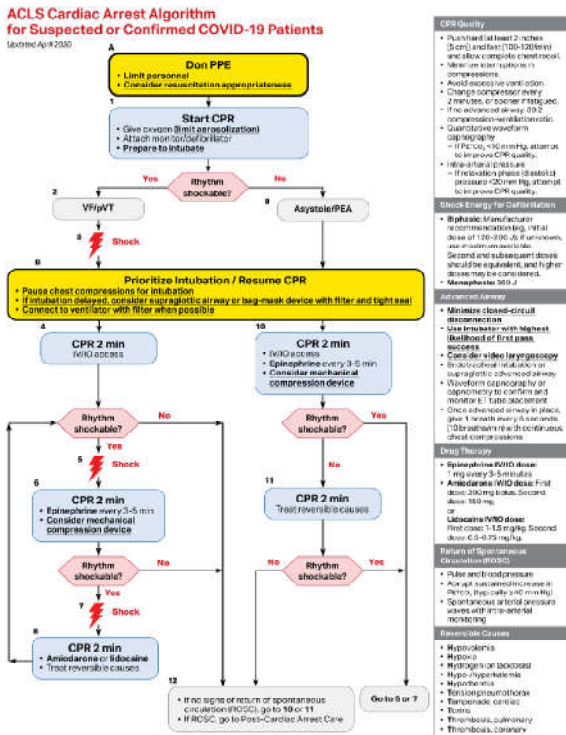
BLS Healthcare Provider Adult Cardiac Arrest Algorithm for Suspected or Confirmed COVID-19 Patients
Updated April 2020



Algorithm 1 BLS in a Adult Cardiac Arrest suspected or confirmed COVID-19 patients¹⁶

It is feasible to consider the general principles for resuscitation in patients with suspected or confirmed covid which includes¹⁶ decreasing the provider exposure to covid, apnoeic oxygenation to maintain airway patency and ventilation, earlier endotracheal intubation to avoid possible aerosol generation risk and to hold chest compressions transiently while intubation to decrease the risk of inhaling infective aerosols by the intubating medical personnel and to consider the

appropriateness of starting and continuing resuscitation. American heart association 2020 updated the basic life support and advanced cardiac life support in suspected or confirmed COVID-19 patients which is depicted in the algorithm below.



Algorithm 2 ACLS adult cardiac arrest in suspected or confirmed COVID-19 patients¹⁶

CONCLUSION

To conclude COVID-19 a new pandemic disease prevailing in all age group needs to be managed conservatively, keeping the standard operating procedure for treating the covid suspected or known case in an appropriate manner. Anaesthetist and intensivist play a pivotal role in managing the airway, non invasive and invasive ventilation, fluid management, maintaining the nutritional status and wearing of PPE is essential in critical care areas.

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Conflict of Interest: Nil declared

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