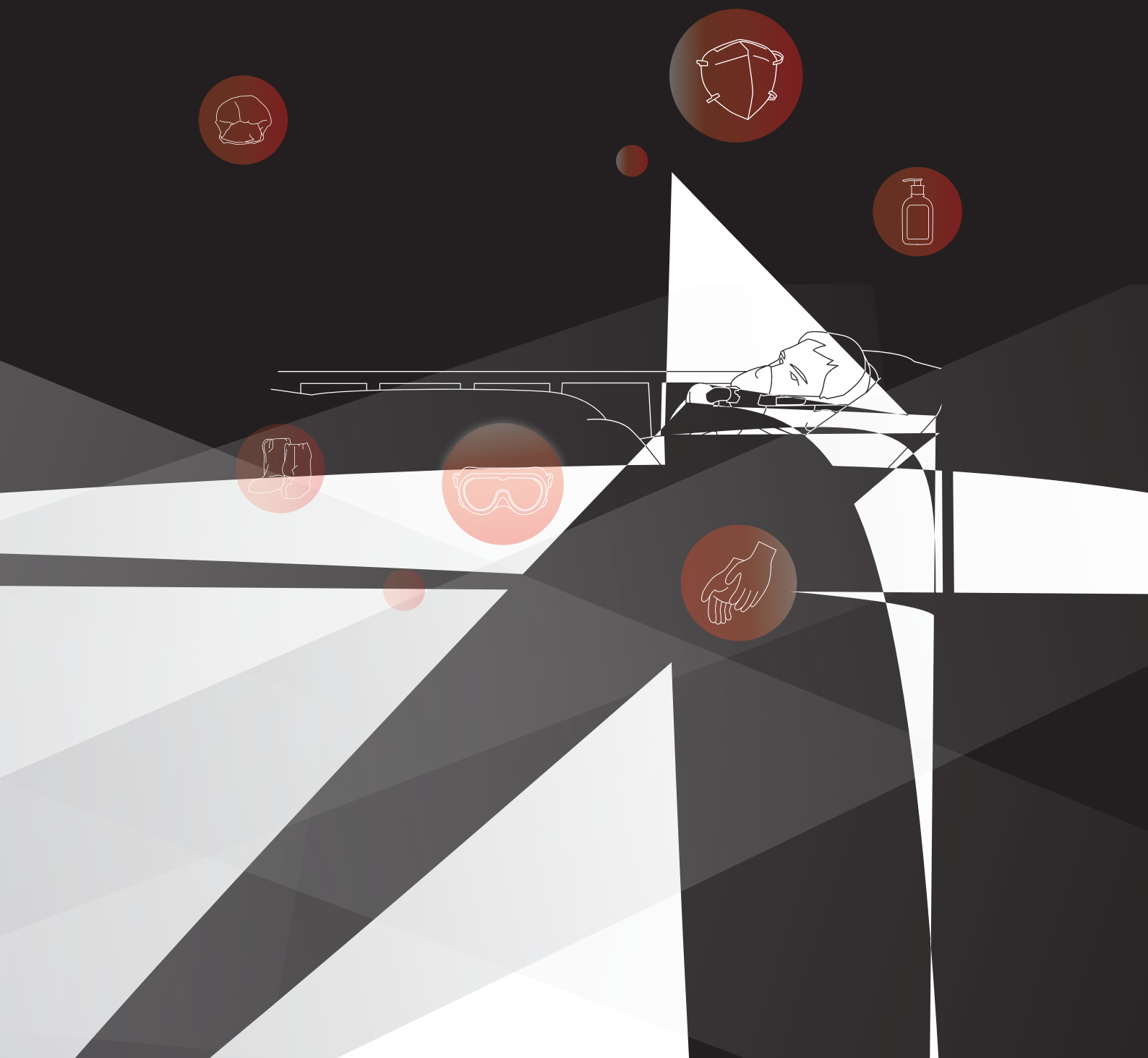
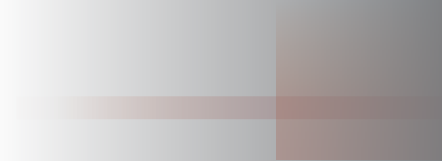


Prevention of airborne transmission during respiratory support of **COVID-19**



More than a million people worldwide have been infected since the World Health Organization declared the COVID-19 a pandemic on March 11th and the reason why is why the urgent demand for personal protective equipment. Respiratory hazards in various forms, mainly airborne inhalation, can cross national boundaries, can challenge efforts to protect workers, and can protect themselves when caring for patients by appropriate use of engineering controls, administrative controls, and personal protective equipment.



Patients with severe COVID-19 should select the appropriate respiratory support. For COVID-19 patients with mild to moderate hypoxemia, high-flow oxygen therapy, and non-invasive ventilation are preferred. Mechanical ventilation (IMV), and external membrane oxygenation are also options. The challenge for prevention and control of infection under these conditions is the characteristic of airborne transmission in COVID-19.

Patient airway management personal protective equipment

1 Reducing Aerosol Dispersion during Nasal Cannula or Nasal High-Flow Oxygen Therapy

Nasal cannula oxygen therapy (NCOT) and high-flow nasal cannula oxygen therapy (HFNCOT) are open-system oxygen delivery methods. With humidification, the flow of oxygen generates a large amount of aerosols which may carry virus. In addition, the high-speed oxygen flow can further aid the spread of virus-containing aerosols to the surrounding environment, which increases the risk of infection for the healthcare workers.

Correctly wearing of surgical or N95 masks for patients can significantly reduce the spread of virus-containing aerosols during coughing and breathing. Some researchers have combined N95 masks with nasal cannula to design a new type of oxygen therapy mask, which can effectively reduce the aerosol transmission. Airtight sealed masks with bacterial and viral filters are also believed to effectively reduce aerosol dispersion.

1. For COVID-19 patients with mild to moderate hypoxemia (oxygenation index > 150 mmHg, 1 mmHg = 0.133 kPa), it is recommended to use NCOT, HFNCOT simple masks and NIV.

NCOT with surgical mask

HFNCOT with surgical mask

NCOT with simple oxygen mask

HFNCOT with simple oxygen mask

2 Reducing Aerosol Dispersion during Non-Invasive Ventilation

Based on multiple studies of SARS, H1N1, it has been proved that non-invasive ventilation may cause aerosol dispersion,



Prevention of Infection: When on accordance with WHO guidelines

When patients require intubation, careful prevention and control measures must be taken in three aspects: the operator, the patient, and the environment. During intubation, the operator should avoid repeated attempts to reduce exposure. When performing intubation, the operator shall follow Grade-3 protection standards and wear protective equipment. It is recommended to quickly intubate in combination with sedatives, analgesics and neuromuscular blockade to reduce coughing. Intubation should be performed in a negative pressure ward, which can effectively reduce the risk of infection to the medical workers.

Clinical Recommendation

1. During intubation, personal protective equipment (PPE) should be worn in accordance with Grade-3 protection standards, and it should be operated, if possible, in a negative pressure ward. An air purifier can be used if it is available.
2. It is suggested that tracheal intubation be done quickly with sufficient sedation and analgesia, to reduce coughing and transmission of droplets.

5 Suctioning during Invasive Mechanical Ventilation

For patients relying on artificial airways, it is strongly recommended that a closed-suctioning device should be used for this therapy. It should be determined carefully whether the patient requires suctioning or not, to avoid frequent and unnecessary suctioning, which may lead to discomfort or cause severe coughing. Suctioning may be considered if and when the patient has the following clinical manifestations:

1. The patient has noticeable secretions in the airway (directly visible or heard through cough sound);
2. The ventilator shows apparent sawtooth in flow-volume loop waveforms or on expiratory flow-time waveforms;
3. The ventilator shows an increase in peak airway pressure (volume-control mode) or a decrease in tidal volume (pressure-control mode);
4. The patient has decreased oxygenation (through a pulse oximeter), increased respiratory rate and compulsory breathing;
5. The patient has worsened arterial blood gas (ABG) results, (e.g. PaCO₂ rose sharply);
6. The patient has increased heart rate and blood pressure, shows irritability or sweating.

For patient requiring high FiO₂ or positive end-expiratory pressure (PEEP) and/or shows significant deterioration of vital signs, pre-oxygenation should be performed for 2 minutes before suction to avoid hypoxemia during suctioning. Disconnecting the ventilator circuit may cause alveolar collapse and large transmission of droplets and aerosol. Therefore, it is recommended to use closed-suction, to reduce the risk of pathogen transmission.

Shallow suctioning can be used to avoid mucosal edema, inflammation, severe coughing, and even bleeding caused by the stimulation of carina and airway. Each suction period is preferably < 15 seconds, and continuous negative pressure should be performed and maintained between 80 and 150 mmHg during suctioning. The closed-suction should be replaced every 24 hours.

Unless required by the patient, conventional bronchoscopy is not recommended for suctioning. Unless necessary, make sure that a three-way connector (i.e. T-Piece) is used to avoid disconnection of the breathing circuit!

Clinical Recommendation

1. Closed-suction should be based on the patient's clinical manifestations. Pre-oxygenation can be given for 2 minutes prior to suction.
2. Shallow suctioning is preferred with each session less than 15 seconds.
3. Conventional bedside bronchoscopy is not recommended. If necessary, a three-way connector (i.e. T-piece) in connection to the breathing circuit.

Reference:

Critical Respiratory Medicine Group at the Respiratory Medicine Branch of the Chinese Medical Association, Critical Care Medical Working Committee at the Respiratory Medicine Branch of the Chinese Medical Doctor Association. Recommendations for Airway Management in Adults with Severe Novel Coronavirus Pneumonia (Trial). Chinese Medical Journal, 2020,100 (00): E004-E004. DOI: 10.3760 / cma.j.issn.0376-2491.2020.0004



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