Oxygenation and Ventilation of COVID-19 Patients

Module 1: Noninvasive Positive-Pressure Ventilation and High-Flow Nasal Cannula

In collaboration with

American Society of Anesthesiologists®

Products are shown for demonstration purposes only. The American Heart Association does not endorse or recommend any specific manufacturer or product.

To show skills clearly, the healthcare providers shown do not always use recommended personal protective equipment (such as gloves, masks, face shields).

Objectives

- To provide just-in-time training for the non–intensive-care-unit healthcare provider for patients requiring ventilation assistance who are under investigation for or confirmed to have COVID-19
- To mitigate risks frequently associated with ventilation-assistance devices, such as noninvasive ventilation (NIV) and high-flow nasal cannula (HFNC) in the COVID-19 pandemic
- To briefly review the benefits and functionality of NIV and HFNC

Risk mitigation

- Attempt to use ventilation equipment and methods with the least aerosol generation
- Noninvasive positive pressure ventilation (NIPPV) and HFNC have a higher risk of aerosol generation than invasive mechanical ventilation and therefore are not routinely recommended in confirmed COVID-19 cases
- Requirements if NIV or HFNC
  - Room: Airborne precautions
  - Equipment: Full face mask and filtered circuits

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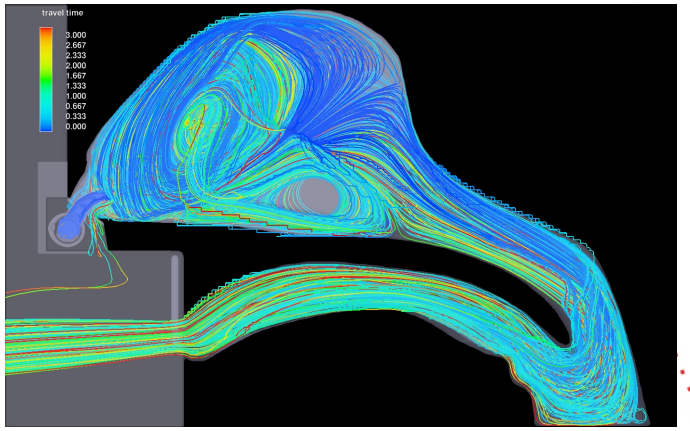
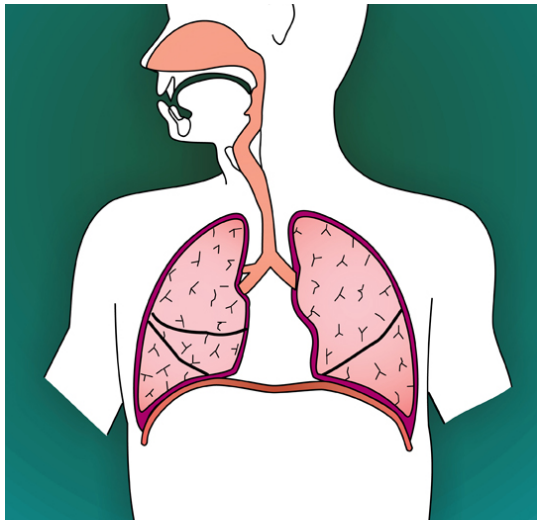
Risk mitigation (cont.)

- NIPPV: Initiation of NIPPV (bilevel positive airway pressure [BiPAP]/ continuous positive airway pressure [CPAP]) requires attending approval; strongly recommended to avoid NIPPV (BiPAP/CPAP) in persons under investigation and confirmed COVID-19 cases
- Rare exceptions are
  - No intubation for those with acute indications for NIV or HFNC
  - Patients who use NIV chronically or are currently stable or improving on NIV or HFNC
  - Exacerbations that are expected to have a rapid reversal such as congestive heart failure
  - Extubation failure or high risk for reintubation
  - Equipment shortages in which milder disease could be managed to save invasive ventilation devices

Quick review of HFNC

- HFNC is recommended over NIV
- Use minimal flow to maintain SpO_2 greater than 88% to 94%; lower flow rates under 30 L/min may have less aerosolization
  - To minimize flow, titrate fraction of inspired oxygen (FIO_2) to maximum support before increasing flow greater than 30 L/min
- Ensure proper size and fit of nasal canula
- Once HFNC has been initiated, an attending needs to assess the patient after 1 hour and after 3 hours to determine if the patient needs to be intubated
- While on HFNC, the patient should have on a loosely fitting surgical mask or face tent
- Do not delay intubation if there is a lack of improvement





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Review of device set-up

- Requirements
  - Gas source and blender
  - Flowmeter: 40 to 60 L/min
  - FIO_2 analyzer
  - Humidifier
  - Surgical mask to reduce aerosol

Respiratory care committee of Chinese Thoracic S. [Expert consensus on preventing nosocomial transmission during respiratory care for critically ill patients infected by 2019 novel coronavirus pneumonia]. Zhonghua jie he he hu xi za zhi. 2020;17(0):E020.

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Quick review of NIV

- NIV provides ventilation assistance with positive pressure at 2 levels:
  - Unload respiratory muscles
  - Lung volumes
- Successful NIV attempt requires that the patient
  - Can maintain an airway
  - Is alert and oriented with a strong respiratory drive
  - Has no facial abnormalities that would prohibit a mask seal
- Typical settings
  - Spontaneous mode
  - Peak airway pressure range from 8 to 20 cm H_2O
  - CPAP or positive end-expiratory pressure (PEEP) range from 5-15
- General guidelines
  - If you need more ventilation (more carbon dioxide [CO_2] removal), adjust the peak airway pressure
  - If you need better oxygenation, adjust the CPAP/PEEP

NIV starting settings

- NIV typical starting pressures
  - Inspiratory pressure (peak inspiratory pressure [PIP], inspiratory positive airway pressure [IPAP]) 10 cm H_2O
  - Expiratory pressure (CPAP/PEEP) 5 cm H_2O
  - FIO_2 1.0

- Titrate to effect
  - If FIO_2 >0.6 to keep SpO_2 greater than 92%, consider increasing expiratory pressure level
  - If respiratory rate continues to be high, consider increasing the inspiratory pressure level

Some common devices

- Several brands and devices available
- Many critical care ventilators can provide NIV
- Requirements for COVID-19
  - FIO_2 .21-1.0
  - CPAP/BiPAP or Bi-level
  - Filtering of exhaled gases
  - Full face mask

Examples only

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Limitation of NIV in COVID-19

- Potential aerosol generation
- Device limitations
  - Some lower-end devices cannot provide a high level of oxygen
  - Circuit configuration