Oxygenation and Ventilation of COVID-19 Patients

Module 1: Noninvasive Support Overview

In collaboration with American Society of Anesthesiologists and American Association for Respiratory Care

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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
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 SpO₂ greater than 88% to 94%; lower flow rates under 30 L/min may have less aerosolization
  • To minimize flow, titrate fraction of inspired oxygen (FiO₂) 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
Review of device set-up

• Requirements
  • Gas source and blender
  • Flowmeter: 40 to 60 L/min
  • FIO\textsubscript{2} analyzer
  • Humidifier
  • Surgical mask to reduce aerosol

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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 H₂O
  • CPAP or positive end-expiratory pressure (PEEP) range from 5-15

• General guidelines
  • If you need more ventilation (more carbon dioxide [CO₂] 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 H₂O
  • Expiratory pressure (CPAP/PEEP) 5 cm H₂O
  • FIO₂ 1.0

• Titrate to effect
  • If FIO₂ >0.6 to keep SpO₂ 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
Limitation of NIV in COVID-19

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