High-Flow Oxygen & Mechanical Ventilation

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High-Flow Oxygen
High-Flow Oxygen Nasal Cannula (HFNC)

• Oxygen Supply System that Can Deliver 100% Humidified Heated Oxygen at Flow Rate of 60 liters per minute

• Mechanisms of HFNC
  Soft Pliable Prongs (Makes seal reducing entrainment)
  Warms and Humidifies Air
  Physiological Dead Space Washout Upper Airway
  CPAP Effect
  Decreases Nasopharyngeal Airway Resistance
High-Flow Oxygen Nasal Cannula (HNFC)

• Clinical Application
  - Acute Hypoxic Respiratory Failure
  - Cardiogenic Pulmonary Edema
  - Post-Operation
  - Pre-Intubation
  - Post-Extubation
High-Flow Oxygen Nasal Cannula (HFNC)

**Settings**

- Flow Rate (5 to 60 liters per minute)
- FiO2 (0.21 to 1.0)

**Initial Set Up**

Flow - may want to start at 20-35 liters per minute and titrate to patient’s work of breathing (WOB).
FiO2 – titrate to SpO2 goal

With increasing flow rate may be able to decrease FiO2
High-Flow Oxygen Nasal Cannula (HFNC)

Monitoring of Patient

- Work of Breathing
- Respiratory Rate
- Breath Sounds
- Subcutaneous Emphysema
- Chest X-Rays
- CT of Thorax
High-Flow Oxygen Nasal Cannula

- **Studies**
    - High-Flow Oxygen through Nasal Cannula in Acute Hypoxic Respiratory Failure
  - Canadian Medical Association Journal (2017)
    - Effect of High Flow Nasal Cannula Oxygen Therapy in Adults with Acute Hypoxemic Respiratory Failure: A Meta-Analysis of Randomized Control Trials
High-Flow Oxygen Nasal Cannula

• Studies Continued
  Efficacy of High-Flow Nasal Cannula Therapy in Intensive Care Units: A Meta-Analysis of Physiological Outcomes

Severe Covid-19
High-Flow Oxygen Nasal Cannula

• Case Study
  26-Year-Old male with no significant past medical history. Presents to emergency room with fever, chills and shortness of breath accompanied with dry cough for three days.

CXR – Multifocal Pneumonia
CT Thorax – Diffuse Bilateral Pulmonary Infiltrates
Positive for COVID-19
Elevated D-Dimer/Ferritin/LDH/ALT/AST
High-Flow Oxygen Nasal Cannula

• Case Study Continued

Antibiotic – Azithromycin
Remdesivir
Convalescent Plasma
Tocilizumab
High-Flow Oxygen Nasal Cannula

• Case Study Continued
  Days 1 & 2 - Nasal Cannula 2-3 liters BNC with SpO2 97-99%
  Day 3 – SpO2 decreased to 90%
    ABGs 7.44/37/72/26/95% on 3 liters BNC
    6 liters BNC to NRB with SaO2 100%
  Day 4 – Increased shortness of breath with SpO2 of 90%
    HFNC – Flow 30 liters per minute with FiO2 of 0.60 with SpO2 @ 100%
  Day 5 - HFNC – Flow 30 liters per minute with FiO2 of 0.60 with SpO2 @ 97%
  Day 6 – HFNC – Flow 30 liters per minute with FiO2 of 0.50 with SpO2 of 93%
  Day 7 – Changed to BNC 8 liters per minute with SpO2 of 90%
  Day 8 – BNC 3 to 5 liters per minute with SpO2 of 90%
Mechanical Ventilation
Mechanical Ventilation – Covid-19

Atelectasis and Interstitial Pneumonia
Severe Hypoxia

• **Intubation**
  Rapid Sequence Intubation (RSI)
  Protective Equipment

• **Mechanical Ventilation**
  Target ARDSnet high PEEP,
  Lung protective tidal volume
  4-8 ml/kg ideal body weight
  Lower inspiratory pressures (plateau pressure < 30cmH2O)
  SpO2 88-95%
Mechanical Ventilation – COVID-19

• Assessment
  Breathing Pattern (Increase WOB)
  Oxygenation
  Peak Inspiratory Pressure/Plateau Pressure
  Frequency/Exhaled Tidal Volume
  AutoPEEP
  Patient-Ventilator Synchrony (Waveforms)
  Breath Sounds
  Excursion
  Palpation for Subcutaneous Emphysema
  Monitor CXRs
Mechanical Ventilation – COVID-19

• Early Proning
  ARDS and PaO2/FiO2 ratio <150
  Protective Equipment

• Consider Extracorporeal Membrane Oxygenation
  Lung protective tidal volume
  4-8ml/kg ideal body weight
  Lower inspiratory pressures (plateau pressure < 30cmH2O)
Case Study - Mechanical Ventilation

• 50-Year-Old Male
  Presented with complaints of shortness of breath and productive cough for two weeks
  Slightly tachypneic with SpO2 of 54% on room air.
  Placed on SFM 10 liters per minute with SpO2 89%
  Became tachypneic (50 breaths per minute) with desaturation of 70%

• Patient was intubated and placed on Mechanical Ventilation
  Day 1 - Assist Control 550/16/10 with FiO2 of 100% with SpO2 94%
  Day 2 - Assist Control 550/16/10 with FiO2 of 60% with SpO2 95%
    Proning
  Day 3 - Assist Control 450/18/10 with FiO2 60% with SpO2 of 95%
    Lung Protective Strategy
  Day 4 - Assist Control 450/18/14 with FiO2 60% with SpO2 of 95%
  Day 5 - Assist Control 450/22/14 with FiO2 60% with SpO2 of 95%
Case Study - Mechanical Ventilation

• Labs
  Elevated D-Dimer/Lactic Acid/Procalcitonin/Troponin
  Negative Blood, Sputum, and Urine Cultures

• Diagnostics
  CXR – Interstitial airspace disease
  CT Thorax (w/o) – Diffuse ground glass and alveolar infiltrates bilaterally
  CT Thorax (w) – Pulmonary embolism

• Medications
  Empiric Antibiotics/Dexamethasone/Lovenox
  Sedation
References


