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High-Flow Oxygen & Mechanical Ventilation

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UTHSC CON

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**

New England Journal of Medicine (2015)

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**

Journal of Intensive Care Medicine (2019)

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

New England Journal of Medicine (2020)

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

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