Critical Care of the Chronic Lung Disease Patients

Ivan Co, MD
Assistant Professor, University of Michigan
Department of Emergency Medicine - Emergency Critical Care
Department of Internal Medicine - Pulmonary Critical Care

Disclosures

• **No** Disclosures
• This lecture will **not** replace obtaining accurate history and physical exam to help guide you to the right diagnosis
• Once you get to the right diagnosis, this lecture will **help** you avoid common pitfalls and provide pointers that will help your practice.
• Thank you to the University of Michigan **PCCM** fellows for their input
Overview

• General management recommendations for patients with chronic lung disease.
• Critical Care pearls for patients with Obstructive Lung Disease
  – COPD
  – Asthma
  – Mechanical Ventilation
• Critical Care pearls for patients with Restrictive Lung Disease
• Critical Care pearls for patients with Pleural Disease

General management recommendations for patients with chronic lung disease.

• “Right heart.”
• “Many pts with chronic lung disease have associated group 3 pulm htn so beware the right heart”
  – Hypoxic pulmonary vasoconstriction + vascular remodeling
    • Worsens RV afterload
  – Prevalence Pulmonary Hypertension between 20-90%.
  – Acute on chronic hypoxic respiratory failure needs evaluation for cardiac contribution.
  – Respect the already strained right heart especially with introduction of Positive Pressure Ventilation.

Budev 2003
Klinger 2016
General management recommendations for patients with chronic lung disease.

- “If really questioning hypoxemia/hypercapnia, please put in some effort and get ABG and not just VBG.”
- “Please look at baseline serum HCO3 and past ABGs to see if they are chronic retainers before overventilating them”

https://lifeinthefastlane.com/investigations/acid-base/

General management recommendations for patients with chronic lung disease.

- “Take a quick peek at the PFTs. Getting a sense of how bad their FVC is (if restrictive disease) or FEV1 (obstructive), DLCO is helpful for determining their reserve if you need to intubate or god forbid, bronch. or hopefully inspire you to do goals of care before any of those things.”
General management recommendations for **intubated** patients with chronic lung disease.

- “Don’t wait until patients are maxed on 100% O2 to intubate if trajectory is poor. They often have poor reserve and will crash hard if you need multiple attempts.”

Predictors of Intubation in Patients With Acute Hypoxemic Respiratory Failure Treated With a Noninvasive Oxygenation Strategy

Frat et al. CCM 2018

### Risk Factors OR (95% CI) p
- In patients treated with conventional O2 therapy by noninvasive route 2.16 (1.13–4.17) 0.02
- In patients treated with high-flow nasal cannula oxygen therapy 2.16 (1.13–4.17) 0.02
- Mean rate of H1 (per breaths/min) 1.05 (1.01–1.09) < 0.01
- In patients treated with noninvasive ventilation 3.14 (1.22–8.09) 0.02
- MD: 50% of predicted body weight at H1 4.36 (1.58–11.48) 0.003

There was no interaction between tidal volume and P0.9/0.9 and initiation of ventilation. This delay did not significantly differ between the two groups with a median delay of 16 hr (9–23) versus 15 (13–28) in NIV group (p = 0.40).

Figure 2. Box plots showing the median delay (25–75th percentiles) in hours between noninvasive ventilation (NIV) initiation and intubation in survivors (white) and nonsurvivors (gray). This delay did not significantly differ between the two groups with a median delay of 16 hr (9–23) versus 15 (13–28) in NIV group (p = 0.40).
General management recommendations for intubated patients with chronic lung disease.

• “Biggest, most consistent error from ED is failing lung protective ventilation (6cc/kg or less to get Pplat< 30).
• “RTs are busy and usually use TV 500cc for men, 400 for women. stop blasting fibrotic or delicate lung!”

General management recommendations for intubated patients with chronic lung disease.

• Tidal Volume at 6cc/kg of IBW

@ 5 feet 5 inch TV= 340
@ 5 feet 7 inch TV= 400
@ 6 feet 3 inch TV = 507
@ 7 feet TV = 630
Critical Care pearls for patients with Obstructive Lung Disease - COPD

• Mainstay treatment: Bronchodilators, Steroids and treatment of underlying cause resulting in exacerbation
• “Keep in mind that PE is present in up to 25% of COPD exacerbations.”
• “Look at prior cultures/sensitivities” -> high risk for pseudomonas, atypicals and increase abx resistance.”
• No difference with Q6hr vs Daily Steroids for exacerbation
• “5 day steroid course non-inferior to 14 day course”
• “No absolute need to correct hypoxia in COPD patients beyond the 88-92% O2 saturation range.”
• “NIV is the preferred initial method of ventilatory support in COPD unless patient absolutely needs to be intubated.”

Critical Care pearls for patients with Obstructive Lung Disease - Asthma

• Mainstay treatment: Bronchodilators, Steroids and treatment of underlying cause resulting in exacerbation
• “If possible, compared peak flows to patient's baseline peak flow”
• “Do not ignore normal pH/pCO2 in a tachypneic patient in distress.”
• “Be extra vigilant in asthma patients without wheezing”
• “Kitchen sink therapeutic strategy in severe attack. Goal is to not get the patient intubated”
• “Ketamine, Epinephrine as adjust (+evidence). Magnesium, Heliox, terbutaline (+/- evidence)
Critical Care pearls for intubated patients with Obstructive Lung Disease

“Be cognizant of auto-PEEP.”

\[ C = \Delta V / \Delta P \]

- Obstructive process: \[ C = \Delta V / \Delta P \] as a result of increase \( \Delta V \) (cannot exhale properly) secondary to lack of elastic recoil
- Increase FRC and TLC
- Results in airflow obstruction, incomplete exhalation, air trapping, poor gas exchange.
- Expiratory Hold to look for AutoPEEP (end expiratory air above set PEEP)
- “Allow for permissive hypercapnia”

Air Trapping/AutoPEEP

Figure 1. Relationship of auto-positive end-expiratory pressure (AP) to PEEP, driving pressure, and terminal expiratory flow during pressure-controlled ventilation. Shaded areas indicate the flow driving pressure gradients during inspiration and expiration. When exhalation terminates before equilibration can be achieved between airway (Paw) and alveolar (PAlv) pressures, end-expiratory flow (arrow) persists, and total PEEP exceeds the set value, producing dynamic hyperinflation that can be modified with changes of breathing pattern.

Published in: John J. Marini; Am J Respir Crit Care Med 2011, 184, 756-762.
Copyright © 2011 American Thoracic Society

Marini 2011
**Critical Care pearls for intubated patients with Obstructive Lung Disease**

- “Calculate $\Delta P = P_{\text{peak}} - P_{\text{plat}}$” to understand lung physiology”
- $\Delta P > 10$ for obstructive lung disease on ventilator

- Manifest as Decreased FRC, TLC, FEV, FVC results high FEV/FVC ratio
- Can manifest as extrapulmonary, pleural, or parenchymal lung disease
- “Look at DLCO”
- “In IPF/ILD, 3 additional investigative category for acute hypoxic respiratory failure:
  - Opportunistic Infection (PCP)
  - RV failure and fluid overload
  - Pulmonary Embolism”
Critical Care pearls for intubated patients with Restrictive Lung Disease

- “Do not BVM ILD/IPF patients” – Low lung compliance causes airflow to go to path of least resistance. Gastric > pulmonary insufflation
- “Only takes 20-25 cm H2O to open lower esophageal sphincter”

Critical Care pearls for patients with Pleural Disease

- “Ultrasound is best tool to assess for pleural effusion and PTX (assess lung point)”
- “However, US limited in chronic lung disease (prior pleurodesis, bullous emphysema, etc) and importance of cross-sectional imaging prior to CT insertion”
- “100cc!!”
  - “Effusion needs diagnostic investigation especially if there is concern for infection or bleeding”
• "Take a Timeout – if you see a hydropneumothorax post thoracentesis in the ED"
• Secondary to 2 common phenomenon:
  – Pneumothorax Ex Vacuo- phenomenon occurs if underlying lung is unable to expand secondary to bronchial obstruction
  – Trapped lung- inability of lung to expand due to restricting fibrous visceral pleural peel
• Neither will resolve with chest tube placement
Questions


Reference