Acute exacerbation of COPD

10BedICU Standard Protocols

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Definition and Clinical Features

Definition

Acute Exacerbation of COPD (AECOPD) is defined as, an event categorized by dyspnoea &/or Cough and sputum production that worsen over a course of 14 days. It is associated with tachypnoea and/or tachycardia, and often with increased local / systemic inflammation caused by airway infection, pollution, or other insults to the airways.

Pathophysiology

The cardinal pathophysiologic feature of COPD is airflow limitation caused by airway narrowing and/or obstruction, loss of elastic recoil, or both. AECOPD leads to acute respiratory failure associated with a significant drop in oxygen saturation of the blood, varying levels of excess carbon dioxide and increased acidemia (↓pH). This leads to a mismatch in the airflow and blood flow in the lungs, leading to decreased oxygenation.

CLINICAL FEATURES

Symptoms

- Comparison to baseline level of symptoms:
  - Worsening dyspnoea
  - Change in characteristics of sputum (amount, colour, purulence, presence of blood)
- Increase in O_2 requirement compared to baseline
- Constitutional Symptoms (fever, chills, night sweats)
- Chest pain
- Palpitations
- Pedal edema

History to Access Severity of the COPD

- Exacerbations (Gold's Criteria)
  - >2 exacerbation / >1 leading to hospitalization
  - 0 or 1 moderate exacerbations (not leading to hospitalization)
- High mMRC score (> grade 2)
- Any spirometry reports available (FEV1 / FVC ratio below 0.7 after bronchodilator)
- Medication History (use of inhalers, antibiotics)
- Smoking >20 Pack Years (Pack Years = 1 pack a day > 20 years)
- Occupational Exposure - Asbestos, Silica & Coal
- Higher BODE index (7-10)
- Tuberculosis
- Cough >3 months
- Asthma, pulmonary embolism, pneumonia, pneumothorax
- Sepsis
- Pulmonary Hypertension
- Viral / Bacterial infection
- Coronary Artery Disease (IHD, CCF, Arrhythmia)*
- Poorly controlled Diabetes Mellitus *
- Renal or Liver Failure*

** These comorbidities worsen the prognosis in AECOPD patients*

mMRC Dypsnoea Scale

Grade 0	Not troubled by breathlessness except on strenuous exercise
Grade 1	Short of breath when hurrying or walking up a slight hill
Grade 2	Walks slower than contemporaries on the level because of breathlessness or has to stop for breath when walking at own pace
Grade 3	Stops for breath after walking 100 meters or after a few minutes on level ground
Grade 4	Too breathless to leave the house or breathless when dressing or undressing

Clinical Features: History & Signs

SEVERITY CLASSIFICATION FOR COPD

Severity	Postbronchodilator FEV1 (% Predicted)	Dyspnoea (mMRC Grade)	Exacerbations in last one year	Complications*
Mild	≥ 80	<2	<2	No
Moderate	50-79	≥ 2	<2	No
Severe	<50	≥ 2	≥ 2	Yes

** Complications include respiratory failure, cor pulmonale, and secondary polycythemia*

BODE Index for Predicting COPD Survival

FEV1 (% of predicted)	
≥65	0 points
50-64	1 points
36-49	2 points
≤35	3 points
6-minute walk distance (meters)	
≥350	0 points
250-349	1 points
150-249	2 points
≤149	3 points
MMRC dyspnea scale	
mMRC 0-1	0 points
mMRC 2	1 points
mMRC 3	2 points
mMRC 4	3 points
Body mass index	
>21	0 points
≤21	1 points

BODE Index Score (Total Points)	Estimated 4-year survival
0-2	80%
3-4	67%
5-6	57%
7-10	18%

Signs

Examination: The goal is to find out if the patient is in respiratory failure or not, characterized by the following signs:

- Altered mental Status#
- SpO_2 <88% Despite oxygen therapy#
- Tachycardia >110 bpm#
- Hypotension MAP <65 mmHg / SBP<90 mmHg#
- Silent Chest on Auscultation - Signifies air obstruction#
- Agitation / Depressed mental status#
- Cyanosis#
- Use of accessory muscles of Respiration (Nasal Flaring, Tracheal tug, and Chest indrawing)#
- Respiratory rate >24/min#
- Difficulty in completing sentences#
- Profound diaphoresis#
- Asynchrony between chest and abdominal wall movement with respiration#
- Flapping Tremor (Asterixis)
- Inability to lie supine
- Cor pulmonale (Tender Hepatomegaly, Pedal Edema, raised JVP, prominent left parasternal heave)
- Rhonchi, Wheeze, Crepitations, on Auscultation
- ABG : Respiratory Acidosis - pH acidic (< 7.30), elevated PCO_2 levels, Low PO_2 (<60 mmHg)
- Tripod sign

Tripod sign

This is a position often assumed by AECOPD patients experiencing respiratory distress.

 # The patient is heading to imminent respiratory failure and will require assisted respiratory support

Investigations

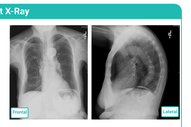
Investigations

Arterial Blood Gas (ABG)

- **Respiratory Acidosis:**
  - pH: Acidic (<7.30) - It is the indication for considering positive pressure ventilation (try NIV first if there's no contraindication)
  - Elevated PCO_2 levels
  - Low PO_2 levels (<60 mmHg)

Chest X-Ray

- **Look for COPD Features:**
  - Flattening of the diaphragm
  - Increased bronchovascular markings (chronic bronchitis)
  - Enlarged heart (chronic bronchitis)
  - Saber-sheath trachea
  - Barrel-shaped chest on lateral view
  - Tubular heart
  - Ability to appreciate >7 intercostal spaces
- **Look for causes of exacerbation:**
  - Consolidation
  - Pleural effusion (blunting of the costophrenic angle)
  - Pneumothorax
  - If chest x-ray is unrevealing: (CT pulmonary angiogram for possible pulmonary embolism) (if available)



Echocardiogram (If available)

Look for signs of Cor Pulmonale:

- Right ventricular (RV) dilation
- Elevated pulmonary artery pressure (>20 mmHg)
- Elevated Right ventricular systolic pressure (>30 mmHg)
- Tricuspid regurgitation
- Pulmonary regurgitation

Blood Investigations

- CBC (Eosinophilia)
- Electrolytes
- RFT
- LFT
- HS Trop I
- NT Pro BNP
- CrP

Microbiological Investigations

- **Sputum Culture**
- **Gram Staining**
- **Gene Xpert / Sputum AFB:** Tuberculosis
- **Tests for Fungal Infection:** Based on predisposing factors and clinical presentation & after consulting pulmonologists

POCUS (If available)

Look for lung:

- A-lines
- B-lines
- Effusion
- Pneumothorax

ECG

Look for:

- Arrhythmia
- Ischemia
- Cor pulmonale

Throat Swab

- COVID
- Influenza
- RSV

Management: Treatment Pathway

Criteria for ICU admission include:

- Continued need for NIV or invasive ventilation
- Hemodynamic instability
- No improvement with frequent nebulizer treatments
- Need for Close monitoring of respiratory status due to impending respiratory failure. (refer to impending respiratory failure signs)

Assess the patient's airway, breathing, and circulation; secure as necessary.

Algorithm for triage of patients presenting with COPD exacerbation

Ensure patient/family consent for NIV and intubation obtained.

- Cardiopulmonary arrest
- Severe hemodynamic instability
- Inability to protect the airway
- Agonal breathing

Yes → Emergent intubation and mechanical ventilation **Admit to ICU**

No → **Patient has severe dyspnea with one or more of the following:**

- Cyanosis or SpO_2 <88% despite supplemental O_2
- Use of accessory muscles of respiration
- Paradoxical chest wall and abdominal movements
- Deteriorating mental status (lethargy, confusion)
- Hypercapnia
- ABG show acute or acute-on-chronic respiratory acidosis (eg, pH <7.35 and PaCO2 >45 [>6 kPa])

Yes → Are there contraindications for NIV

- Yes → Intubation & mechanical ventilation. **Admit to ICU.**
- No → Initiate NIV and monitor closely with ABG.

No → Patient has indications for ICU admission other than for ventilatory support

- Yes → **Admit to ICU**
- No → Consider management of patient in medical unit or other appropriately

Recommend Continuous observation of patients to ensure
1. Patients response to NIV
2. Patient tolerates NIV
3. Improvement in oxygenation
4. Improvement in respiratory acidosis

Contraindication of NIV

1. Impaired consciousness with inability to protect the airway
2. Active vomiting

Refer to Respiratory distress chapter for NIV contraindications and settings and optimization of NIV

Management

Noninvasive ventilation (NIV)

Appropriate for the majority of patients with severe exacerbations of COPD unless immediate intubation is needed or NIV is otherwise contraindicated. For NIV Management and setting, ref to respiratory distress - NIV Chapter

- **Initial settings for bilevel NIV:** 8 cm H_2O Inspiratory Pressure (may increase up to 15 cm H_2O if needed to aid ventilation); 3 -5 cm H_2O Expiratory Pressure
- **Administer bronchodilators via nebulizer or MDI:** Nebulizer usually requires interruption of NIV; MDIs can be delivered in line using adaptor (refer to dosing)
- **Obtain ABG between 30 min to 2 hrs of NIV and compare with baseline:** Worsening or unimproved gas exchange and pH <7.25 are indications for invasive ventilation

Tracheal intubation and mechanical ventilation:

Indicated for patients with acute respiratory failure, hemodynamic instability (eg, heart rate <50 bpm, uncontrolled arrhythmia) and those in whom NIV is contraindicated or who fail to improve with NIV and aggressive pharmacotherapy

- RSI - Refer to RSI Chapter
- Initial ventilator settings aim to maintain adequate oxygenation and ventilation while minimizing elevated airway pressures:
  - SIMV, tidal volume 6 to 8 mL/kg, respiratory rate 10 to12 bpm
  - Inspiratory flow rate 60 to 80 L/min (increase if needed to enable longer expiratory phase), PEEP 5 cm H_2O.
  - May need to tolerate elevated $PaCO_2$ to avoid barotrauma (i.e. permissive hypercapnia)
  - In patients with chronic hypercapnia, aim for $PaCO_2$ close to baseline
- Administer inhaled bronchodilator therapy: Usually via MDI with in-line adaptor (refer to dosing)
- Ensure adequate sedation for patients on intubation

Monitoring of Patient

- Perform continual monitoring of oxygen saturation, blood pressure, heart rate, respiratory rate
- Close monitoring of respiratory status
- Continuous ECG monitoring
- Monitor blood glucose
- Obtain ABG in all patients with severe COPD exacerbation

NOTE: Consult the HUB doctor, after initial stabilization and as and when required.

Pharmacotherapy & Abbreviation

Pharmacotherapy

- **Inhaled beta agonist:** Salbutamol2.5 mg diluted to 3 mL via nebulizer or 2 to 4 inhalations from MDI every hour for 2 or 3 doses; up to 8 inhalations may be used for intubated patients, if needed.
- **Short-acting muscarinic antagonist (anticholinergic agent):** Ipratropium 500 µg (can be combined with Salbutamol) in 3 mL via nebulizer or 2 to 4 inhalations from MDI every hour for 2 to 3 doses.
- **Intravenous glucocorticoid:** Methlprednisolone Loading dose of 80 - 120mg, Followed by Methyprednisolone 40-80mg IV BID or OD based on the clinical condition of the patient. Consult the HUB if the patient is not responding after the initial dosage.
- **Antibiotic therapy*:** Appropriate for majority of severe COPD exacerbations; select antibiotic based on likelihood of particular pathogens (eg, Pseudomonas risk factors¶, prior sputum cultures, local patterns of resistance).
  - **No Pseudomonas risk factor(s)*:** Ceftriaxone 1 to 2 grams IV twice daily, or cefotaxime 1 to 2 grams IV every 8 hours, or levofloxacin 500 mg IV or orally once daily, or moxifloxacin 400 mg IV or orally once daily
  - **Pseudomonas risk factor(s)*:** Piperacillin-tazobactam 4.5 grams IV every 8 hours, or cefepime 2 grams IV every 8 hours, or ceftazidime 2 grams IV every 8 hours
- **Antiviral therapy (influenza suspected)*:** Oseltamivir 75 mg orally every 12 hours or peramivir 600 mg IV once (for patients unable to take oral medication)

** Do not delay therapy if suspecting influenza, dose adjustment required in renal failure and liver failure appropriately*

¶ Pseudomonas infection risk factors: Broad spectrum antibiotic use in the past 3 months; chronic colonization or previous isolation of Pseudomonas aeruginosa from sputum (particularly in past 12 months); very severe underlying COPD (FEV_1 < 30% predicted); chronic systemic glucocorticoid use.

Abbreviations

- ABG: arterial blood gas
- BNP: brain natriuretic peptide
- BODE: Body-mass index, airflow Obstruction, Dyspnea, and Exercise
- BUN: blood urea nitrogen
- COPD: chronic obstructive pulmonary disease
- ECG: electrocardiogram
- $ETCO_2$: end-tidal carbon dioxide
- FiO_2: fraction of inspired oxygen
- ICU: intensive care unit
- IV: intravenous
- MDI: metered dose inhaler
- mMRC: Modified Medical Research Council
- NIV: noninvasive ventilation
- NT-ProBNP: N-terminal pro-BNP
- PCO_2: arterial tension of carbon dioxide
- PO_2: arterial tension of oxygen
- PE: pulmonary embolism
- PEEP: positive end-expiratory pressure
- POCUS: Point of Care Ultrasound
- RSV: respiratory syncytial virus
- SIMV: synchronized intermittent mechanical ventilation;