

MUNI  
MED

# COPD exacerbation

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# Learning outcomes

- Student learns signs and symptoms of COPD exacerbation
- Student is oriented in differential diagnosis of acute dyspnoea
- Student knows main treatment of COPD exacerbation
- Student learns basics of ventilatory support

# COPD Exacerbation

○exacerbation = acute worsening of respiratory symptoms

○causes:

○70% infection

- most often viral (rhinovirus)

○pollution, pulmonary embolism, ...

○risk factors:

○GOLD 3 or 4

○2 or more exacerbations per year

○pulmonary hypertension

○lasts usually 7 – 10 days

○leads to COPD deterioration

# Pathophysiology

chronic inflammation

**chronic bronchitis:**  
bronchospasm  
smooth muscle hypertrophy  
increased mucus production

**emphysema:**  
destruction of alveolar membrane

↑ airway resistance

↓ lung elastance

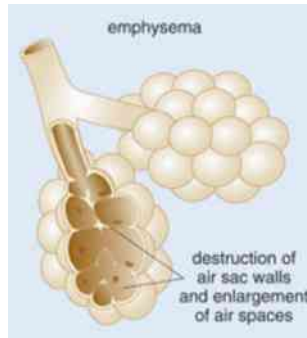
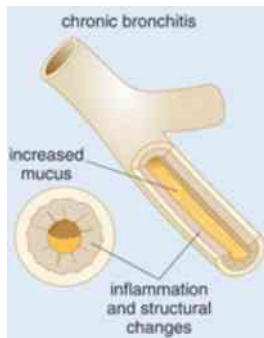
↓ alveolar area

dynamic hyperinflation

V/Q mismatch

hypercapnia

hypoxemia



<https://www.open.edu/>

# Signs and symptoms

- dyspnea
- tachypnea
- use of auxiliary respiratory muscles
- auscultation:
  - prolonged expirium, wheezes, silent chest
- unconsciousness
- right heart failure

# Diagnostics

- pulse oximetry
- lab studies:
  - ABG



zdroj: wikimedia.org

ABG	admis.
pH	7,41
pCO2	8,4
pO2	8,8
HCO3	29,6
BE	12,8

**compensated**  
respiratory acidosis

ABG	2 h later
pH	7,23
pCO2	10,1
pO2	8,5
HCO3	29,6
BE	12,8

**DEcompensated**  
respiratory acidosis

# Diagnostics

- pulse oximetry

- lab studies:

  - ABG

  - CBC, glucose, electrolytes, CRP/PCT

  - D-dimer, NT-proBNP, troponin

  - sputum culture

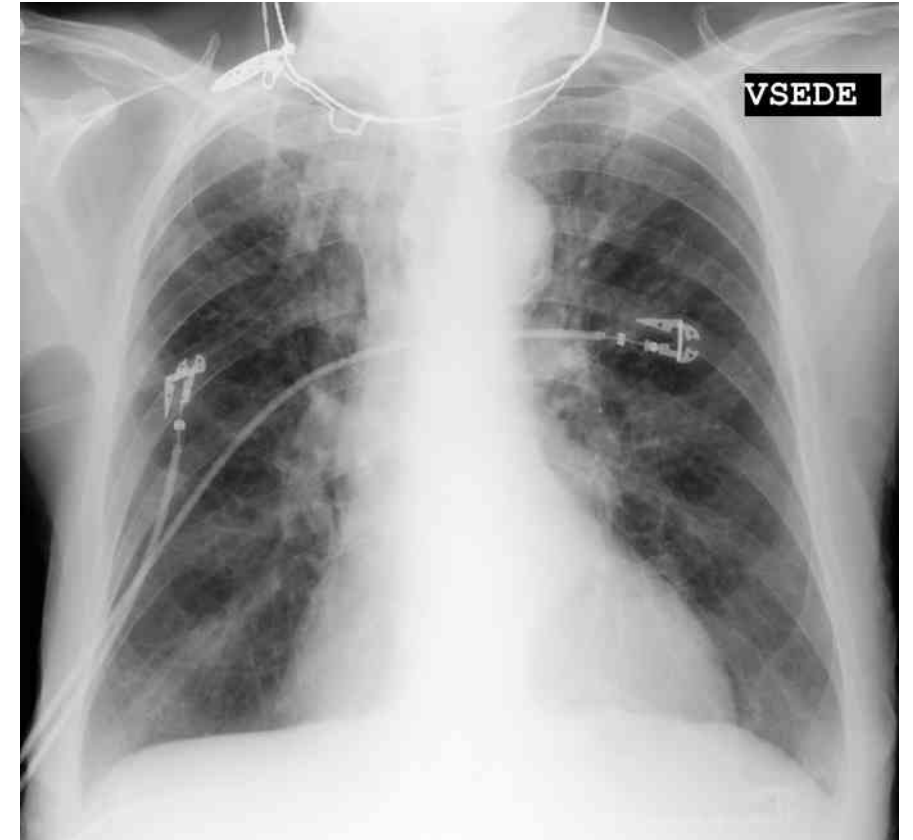
  - PCR: COVID-19, influenza

- Chest X-ray: signs of hyperinflation

  - to exclude pneumonia, pneumothorax, pulmonary edema, pleural effusion

- lung ultrasound

- Lung CT, CT pulmonary angiogram (CTPA)



# Differential diagnosis

- pneumonia (X-ray, CRP, PCT)
- pneumothorax, pleural effusion (US, X-ray, CT)
- pulmonary embolism (D-dimer, US, CTPA)
  - prevalence in COPD exacerbation is 16%
- cardiogenic pulmonary edema (TTE, ECG, NT-proBNP, troponin)



# Initial management

• vital functions (ABCD) including SpO<sub>2</sub>

• oxygen therapy:

• target SpO<sub>2</sub> 88 – 92 %

• excessive (SpO<sub>2</sub> > 94%):

- impairs CO<sub>2</sub> elimination
- increases mortality

• pharmacotherapy:

• based on short acting beta<sub>2</sub> agonists (formoterol, salbutamol)

- effect lasts 4-6 hours
- MDI 4-8 breaths or nebulizer, repeat hourly in the beginning
- side effects: sinus. tachycardia, arrhythmia (tremor, hypokalemia)



# Therapy

## ○ pharmacotherapy

### ○ short acting anticholinergics (ipratropium)

- effect lasts 4-6 h
- minimal side effects
- supplement to beta<sub>2</sub> agonists, the same dosing intervals

### ○ corticoids:

- prednisone – dose 40 mg/day p.o., alternatively methylprednisolone i.v.
- duration 5 (max. 7) days, no indication for long-term use
- inhalation route (budesonide 4 – 8 mg/den) has comparable effect (Yong-Li G, *J Clin Pharm Ther* 2020)

### ○ antibiotic in case of increased sputum production, ↑ CRP/PCT, lung consolidation on X-ray

### ○ methylxanthines (theophylline) are not recommended

# Non-invasive ventilation (NIV)

- indications: dyspnea, hypoxemia during O<sub>2</sub>, acidosis (pH < 7,35)
- face mask or helmet
- modes:
  - CPAP – simple
  - PSV – can decrease work of breathing, support of 7-10 cm H<sub>2</sub>O
- FiO<sub>2</sub> to maintain SpO<sub>2</sub> 88 – 92 %
- do not aim at normal pCO<sub>5</sub> but normal pH (mild acidosis should be tolerated)
- low PEEP (3-5 cm H<sub>2</sub>O)

# Mechanical ventilation

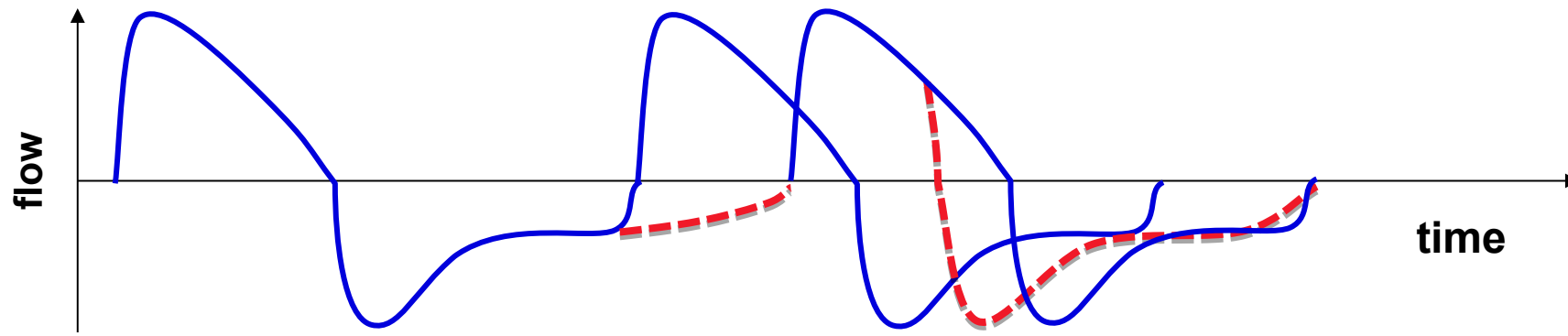
## Indication for intubation and MV:

- significant hypoxemia ( $\text{SaO}_2 < 88\%$ ) or acidosis ( $\text{pH} < 7,25$ )
- intolerance of NIV
- unconsciousness
- exhaustion, insufficient airway clearance
- hemodynamic instability

## ventilator setting:

- $\text{FiO}_2$  to maintain  $\text{SpO}_2$  88-92 %
- low respiratory rate, short inspirium
- low PEEP ( $\downarrow$  work of breathing during spontaneous breaths)

# Dynamic hyperinflation



# Take home message

- oxygen therapy for all hypoxemic patients but only as much as necessary
- arterial blood gases are mandatory
- short acting beta<sub>2</sub> agonist and corticoids are the mainstay of therapy
- NIV is the preferred type of ventilation

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