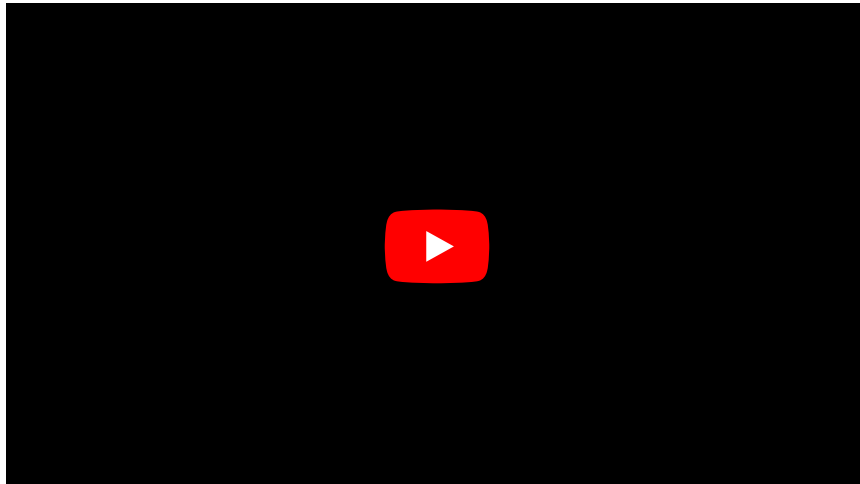
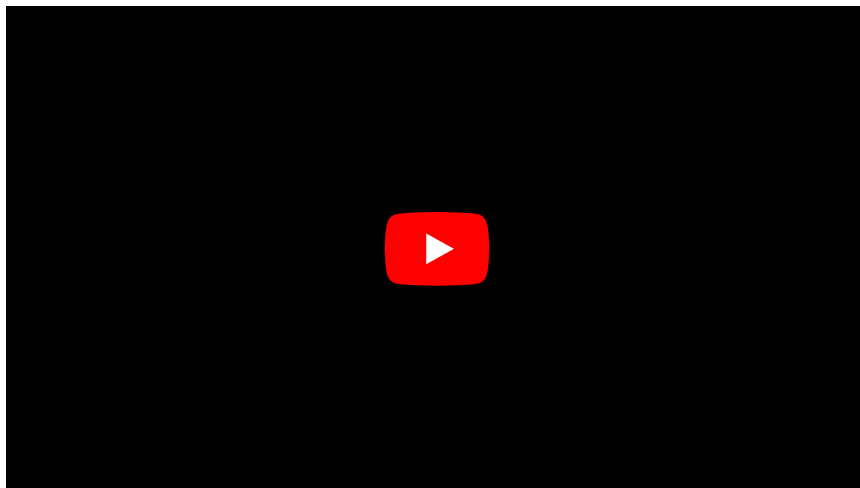


# COPD

## COPD:



## COPD 2:



Template:Infobox - disease **Chronic obstructive pulmonary disease** (COPD, COPD) is a serious disease whose main feature is *bronchial obstruction* (restricted air flow in the bronchi), which is *not fully reversible*. Abnormal inflammatory reactions to harmful substances and gases in inhaled air arise on the basis.

Affects the lower respiratory tract, peripheral bronchioles (obstructive bronchiolitis), lung parenchyma (emphysema) and pulmonary vessels (development pulmonary hypertension). A mostly neutrophilic type of inflammation develops here with all its negative manifestations (repeated damage, repair, fibroproduction).

The development of this disease takes decades, it is insidious and seemingly inconspicuous.

## Etiology and epidemiology of disease

COPD is most often **a consequence of smoking tobacco**. The biggest risk factor is smoking cigarettes, but also cigars and pipes. Exposure to *secondhand smoke* can increase the risk of developing COPD by up to 48% compared to the general population. Factors from the external environment are also involved – air pollution, dust and chemical fumes in the work environment. Genetic predisposing factors for the development of COPD are also possible - deficiency of  $\alpha_1$ -antitrypsin.

In the Czech Republic, about 8% of the population, mainly men, are affected, but the incidence in women is increasing (smoking), the death rate as a result of this disease is about 2,000 patients per year. The cause of death is cardiovascular disease or bronchogenic carcinoma (for stage I and II), respiratory failure (stage III and IV).

## Disease Symptoms

### Pulmonary:

- **cough** - usually all day, rarely only at night;
- **expectoration** (coughing up mucus) – chronic production of sputum;
- **dyspnea** which tends to progress;
- reduction of physical exertion tolerance (follows shortness of breath).

**Systemic** - result from alteration of the patient's overall health condition (stage III, IV):

- cachexia;
- muscle atrophy.

## COPD exacerbation

An exacerbation is an **event during the course of the disease** when there is a **significant worsening of symptoms of COPD beyond their normal level**. *At the same time, new symptoms appear* - use of auxiliary respiratory muscles, paradoxical breathing movements, worsening or emergence of central cyanosis, peripheral edema, right-sided heart failure up to decreased level of consciousness. The occurrence of an exacerbation is a valid reason to seek medical attention, as it is very likely that a change in therapy will be necessary.

Decompensation of the patient's condition during a "severe exacerbation" threatens his life, usually requiring the introduction of ventilation support. One symptom from the following is enough to determine it:

- change consciousness (sleepiness, confusion or agitation to aggressiveness);
- increase in respiratory rate > 25 breaths per minute;
- increase in heart rate > 110 per minute;
- fall in FEV<sub>1</sub> below 1 l.

## Disease Classification

COPD classification is based on lung function values determined by spirometric examination. Bronchodilators are administered before spirometry. **We are interested in the post-bronchodilation values** (the ability of bronchodilation decreases in patients):

- FEV<sub>1</sub> – forcefully exhaled volume in 1 s;
- the FEV<sub>1</sub>/FVC ratio, where FVC is the effortful vital capacity - the so-called '*Tiffeneau's index*'.

According to the examination results, COPD is divided into four stages: mild, moderate, severe and very severe.

Stages of COPD<sup>[1]</sup>

COPD stage	Results of spirometry	Clinical picture of the patient
<b>I - light</b>	FEV <sub>1</sub> /FVC < 0.70, FEV <sub>1</sub> ≥ 80% proper values	The patient may (but may not) have a chronic cough, expectoration, at the same time he may not be aware that his lung function is already abnormal. The patient may also be free of chronic symptoms, but they are usually present and progressing.
<b>II - Moderate</b>	FEV <sub>1</sub> /FVC < 0.70, FEV <sub>1</sub> = 50-80 % of appropriate value	exertional dyspnea appears, which usually forces the patient to seek medical attention. Exacerbations may occur.
<b>III - severe</b>	FEV <sub>1</sub> /FVC < 0.70, FEV <sub>1</sub> = 30-50% appropriate values	Again, cough and expectoration may not be present, but shortness of breath worsens, which significantly limits the patient even during normal daily activities. Exacerbations are repeated, the quality of life is worsened.
<b>IV - very severe</b>	FEV <sub>1</sub> /FVC < 0.70, FEV <sub>1</sub> < 30% of the due value, or < 50% and at the same time there is a complication of the disease (pulmonary hypertension, cor pulmonale, chronic respiratory insufficiency)	The quality of life is greatly impaired. Exacerbation can be life-threatening for the patient.

It follows from the data in the table that *even a person without symptoms (cough, expectoration) can have an obstructive ventilation disorder*. Coughing and expectoration usually do not bother the patient much, they are usually associated with smoking. They seek a doctor only because of worsening shortness of breath.

## Complications of the disease

Pulmonary hypertension, cor pulmonale and chronic heart failure are caused by damage to the pulmonary parenchyma and blood vessels.

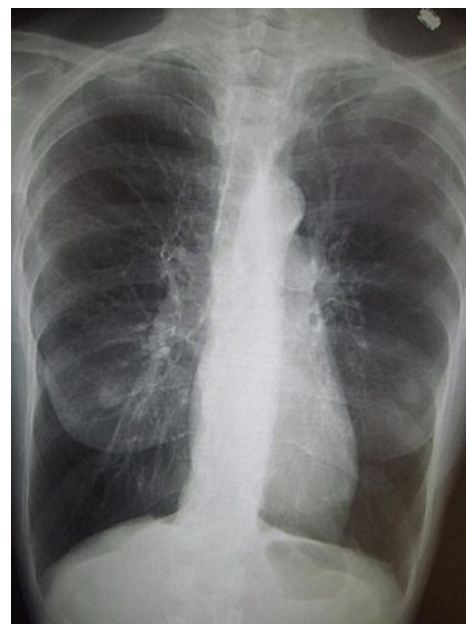
Serious comorbidities also arise that worsen the overall condition of the patient:

- cardiovascular – arterial hypertension, ICHS;

- metabolic – DM type 2, metabolic syndrome, osteopenia, osteoporosis;
- psychiatric – anxiety states, depression, sleep disorders;
- anemia from chronic diseases;
- bronchogenic carcinoma – COPD is a risk factor for its occurrence.

## Diagnosis

- **Anamnesis** - risk factors (smoking, work and social history, COPD in the family history), previous respiratory diseases, search for possible exacerbations, presence of comorbidities and their therapy;
- **physical examination** - is relatively unhelpful;
- **hemoglobin saturation with oxygen** - drop in  $SpO_2$  below 92%;
- **X-ray of the chest** - in two projections (anterior, lateral), is important above all for the exclusion of other diseases such as bronchogenic carcinoma, bullous emphysema (the signs of COPD are hyperinflation - flattening of the diaphragm on the lateral image, enlargement of the retrosternal space, increased transparency lungs, rapid reduction of the pulmonary vascular bed).
- **Spirometry:**
  - determining the flow/volume loop;
  - conducting a bronchodilation test - a result of  $FEV_1$  of less than 12% or 200 ml is considered to be confirmation of a bronchodilation disorder;
  - examination of the diffusing capacity of the lungs for CO (TLCO) – when emphysema is suspected.
- **Blood gas examination** -  $p_a(O_2) < 8$  kPa with or without  $p_a(CO_2) > 6$  kPa indicates respiratory insufficiency.
- **Laboratory examination:**
  - signs of inflammation (elevated CRP);
  - blood count – leukocytosis, anemia.
- **Examination of  $\alpha_1$ -antitrypsin** - in patients who develop COPD before the age of 50.



**X-ray of a patient with COPD**, posterior-anterior projection, visible flattening of the diaphragm

## Therapy

The goals of therapy are to alleviate symptoms, prevent disease progression, prevent exacerbations, improve general condition and physical performance, and reduce mortality. General therapy includes:

- **absolute cessation of smoking** - unconditionally;
- **pharmacotherapy**;
- *'treatment of comorbidities*
- **long-term home oxygen therapy (DDOT)**;
- **Preventive measures**;
  - vaccination against influenza (containing dead or live inactivated viruses) - reduces disease severity and mortality in COPD patients by up to 50%, recommended annually;
  - vaccination against pneumococcal infection – in patients older than 65 years and/or with  $FEV_1$  values  $< 40\%$  of appropriate values;
- **rehabilitation** - part of complex treatment from II. stages (breathing gymnastics, respiratory physiotherapy);
- **surgical treatment** - bullectomy (removal of bullous emphysema), volume reduction surgery, lung transplantation (criteria for transplantation are  $FEV_1 < 35\%$  of the appropriate value,  $p_a(O_2) < 7.3-8.0$  kPa (55–60 mm Hg),  $p_a(CO_2) 6.7$  kPa (50 mm Hg) and secondary pulmonary hypertension).

File:AB COPD Mokrejs.jpeg

COPD and asthma treatment scheme based on GOLD and GINA 2019 guidelines

## Pharmacotherapy

COPD pharmacotherapy is only symptomatic, its aim is to stop the progression of the disease or achieve improvement. Preferred is *'inhalation administration of drugs, often combinations of drugs*.

### Inhalation bronchodilators

- **with short-term effect:**

1. SABA – short-acting inhaled  $\beta_2$  agonists (Template:HVLP, Template:HVLP);
2. SAMA – short-acting inhaled anticholinergic (ipratropium bromide Template:HVLP);

- **with long-term effect:**

1. LABA – long-acting inhaled  $\beta_2$  agonists (Template:HVLP, Template:HVLP);
2. LAMA – long-acting inhaled anticholinergic (tiotropium bromide Template:HVLP, glycopyrronium bromide);
3. ULABA - ultra-long-acting inhaled  $\beta_2$  agonists (Template:HVLP).

### Inhaled corticosteroids

Regular administration of inhaled corticosteroids is indicated in severe COPD (stage III), moderate to high doses are given, often in combination with a LABA. They have been shown to reduce exacerbations but not mortality. Unlike asthma therapy, ICS do not reduce inflammation.

## Therapy according to the stages of COPD

It is always necessary to quit smoking.

- I (mild stage) – inhaled bronchodilators with a short-term effect as needed.
- II (moderately severe stage) – add one or more long-acting bronchodilators.
- III (severe stage) – add ICS for repeated exacerbations.
- IV (very severe stage) – add DDOT and consider surgical treatment.

## Risk of oxygen administration during exacerbations

A patient with chronic lung damage has a long-term elevated level of carbon dioxide (he is unable to exhale it). He is adapted to it, has a normal pH and his respiratory center for CO<sub>2</sub> is "retuned". The patient is more responsive to a drop in oxygen levels. It is reduced in these patients (the patient also poorly receives oxygen).

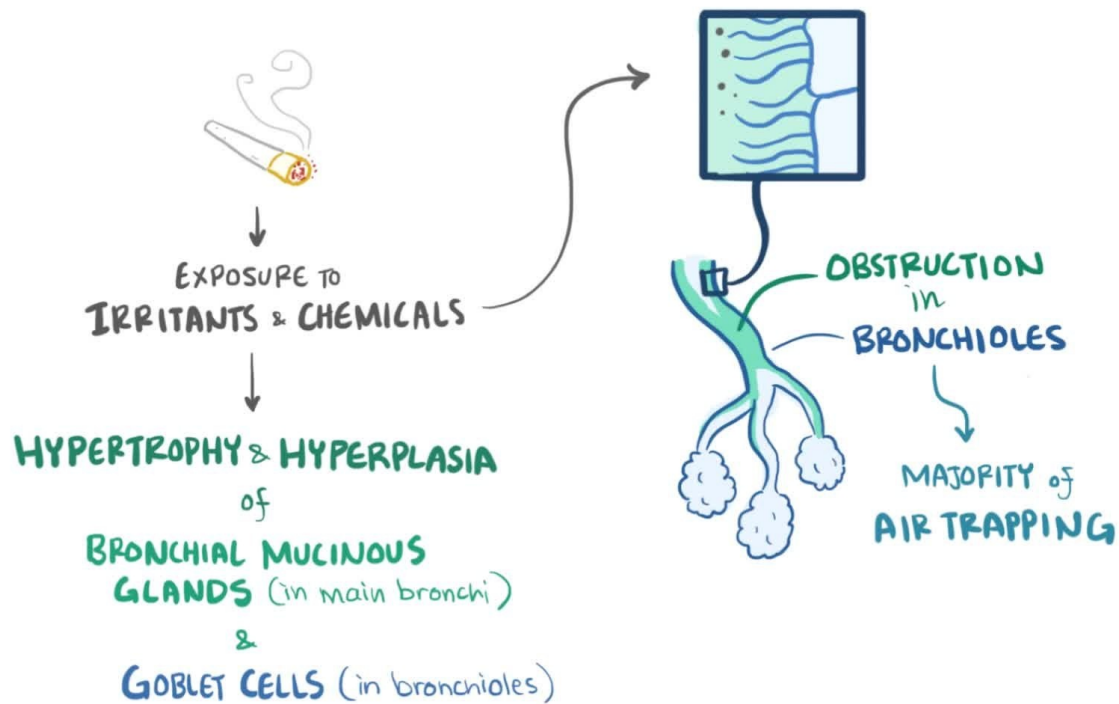
When higher concentrations of oxygen are administered for a longer period of time, the patient begins to hypoventilate due to changes in blood flow to the lungs - the patient's blood is saturated with oxygen above its long-term values. During this hypoventilation, the level of CO<sub>2</sub> in the blood rises to values that depress the CNS. The patient is put to sleep with their own CO<sub>2</sub>. He stops breathing completely. Subsequently, hypoxia occurs again, but the patient no longer reacts to it by breathing and dies of suffocation. The solution is to manage oxygen therapy in patients with COPD according to the state of consciousness and the oximeter.

**Target saturation in a chronic patient is approx. 90%.** Oxygen goggles with a flow rate of 2-3 l/min are optimal. With significant shortness of breath and saturation drops below 85%, oxygen administration with high flow rates through a mask is possible, but we must respond to the adjustment of the condition and reduce the patient's oxygen intake when values above 88% are reached. Pulmonary vasoconstriction and the Haldane effect online ([https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3682248/?fbclid=IwAR13YIJVZ\\_CEMwH0qC-HCZliAxYO-Bx5ZtU1swyNdgzMckLBxQlImhCzdUEo](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3682248/?fbclid=IwAR13YIJVZ_CEMwH0qC-HCZliAxYO-Bx5ZtU1swyNdgzMckLBxQlImhCzdUEo)) and carbon-dioxide-retention-in-copd/?fbclid=IwAR2x8DzRUy50Zfz0OJRYkecMMSz60Tgo4\_CYokhYQCDktkLPZZCi\_28naV0 clinical summary (<https://litfl.com/oxygen-and->)

## Outpatient patient monitoring

A patient with COPD should undergo a check-up with their general practitioner (or pneumophtease specialist) every 3 months, where there should be a check of changes in subjective symptoms, a check of smoking abstinence (or anti-smoking intervention) , physical and *spirometric examination*, examination of hemoglobin oxygen saturation measured with a pulse oximeter, compliance with treatment and control of inhalation technique, monitoring of comorbidities and their treatment, monitoring of adverse effects of treatment, monitoring of patients' quality of life. Patients with a predominance of emphysema should be examined once a year for transfer factor, and stage III and IV patients should have bodyplethysmography performed once a year.

## Recap Video



## Links

### Related Articles

- Chronic bronchitis
- Cor pulmonale
- Bronchogenic carcinoma
- Spirometry
- Oxygen Therapy

### External links

- COPD and ECG (TECHMED) (<https://www.techmed.sk/chronicka-obstrukcna-choroba-pluc/>)

### Source

1. CZECH, Richard. *Intern.* 1. edition. Prague : Triton, 2010. 855 pp. pp. 461. ISBN 978-80-7387-423-0.

### References

- CZECH, Richard. *Intern.* 1. edition. Prague : Triton, 2010. 855 pp. pp. 460-465. ISBN 978-80-7387-423-0.
- CR. Czech Pneumology and Phthysiology Society ČLS JEP. Recommended procedure for the diagnosis and treatment of chronic obstructive pulmonary disease (COPD) - stable phase. 2010. Available from <<http://www.pneumologie.cz/odborne/doc/DPdef2.doc>>.