

## **Lecture 3**

# **Chronic dust bronchitis. Chronic occupational obstructive pulmonary disease.**

(2 hours)

### **Scientific and methodological substantiation of the topic**

Dust bronchitis is one of the occupational diseases, caused by prolonged impact of production dust. It is characterized by diffusive inflammation of bronchi and is an initially chronic diffusive endobronchitis. As a nosological form, dust bronchitis was enlisted in the list of occupational diseases in 1970. Under modern conditions, dust bronchitis develop rather slowly, in 8 to 10 years of work under dust impact, and can be met in various industries in different countries.

As of 2018, COPD affected about 174.5 million people (2.4% of the global population). It typically occurs in people over the age of 40. Males and females are affected equally commonly. In 2015, it resulted in 3.2 million deaths, up from 2.4 million deaths in 1990. More than 90% of these deaths occur in the developing world. The number of deaths is projected to increase further because of higher smoking rates in the developing world, and an aging population in many countries. It resulted in an estimated economic cost of \$2.1 trillion in 2010.

### **Literature**

1. Occupational diseases / V.A. Kapustnik, I.F. Kostyuk. – Kyiv, AUS Medicine Publishing, 2018. – 496 p.
2. Occupational diseases : пособие для студентов фак. иностран. учащихся с англ. яз. обучения / УО «ГрГМУ» ; Каф. фтизиопульмонологии. – Гродно : ГрГМУ, 2014. – 73 с.
3. Consultant of the doctor. Electronic medical library [Электронный ресурс] / Издательская группа «ГЭОТАР-Медиа», ООО «ИПУЗ». – Режим доступа: <http://www.rosmedlib.ru/>. – Дата доступа: 23.03.2019.
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1. Oxford Medicine Online [Electronic resource] / Oxford University Press. – Access mode: [www.oxfordmedicine.com](http://www.oxfordmedicine.com). – Date of access: 23.09.2019.
2. Springer Link [Electronic resource] / Springer International Publishing AG. – Access mode: <https://link.springer.com>. – Date of access: 23.03.2019.

### **Methodical support**

1. Media presentation

### **Lecture time calculation**

№	Questions	Time (min)
1.	Chronic dust bronchitis: definition, clinics, diagnostics, treatment.	20
2.	Chronic occupational obstructive pulmonary disease (COPD): clinics, diagnostics, treatment.	40
3.	GOLD.	Students' self-studying 30

## 1.Chronic dust bronchitis: definition, clinics, diagnostics, treatment

Dust bronchitis is one of the occupational diseases, caused by prolonged impact of production dust. It is characterized by diffusive inflammation of bronchi and is an initially chronic diffusive endobronchitis.

As a nosological form, dust bronchitis was enlisted in the list of occupational diseases in 1970.

Under modern conditions, dust bronchitis develop rather slowly, in 8 to 10 years of work under dust impact, and can be met in various industries (table 1).

*Table 1*

**List of industries, potentially hazard for the development of dust bronchitis  
(Yu.Kundiev and O.Krasnyuk)**

Production, Occupation	Factors, which cause bronchitis development	Other Possible Forms of Dust Pathology
1	2	3
Coal industry (workers of face factories, tunnellers, drivers of coal coal-plough machines)	Dust, containing quartz and coal; irritating gases (methane); hot microclimate and high humidity	Pneumoconiosis
Mining industry (borers, tunnellers and shot-firer)	Dust, containing quartz	Pneumoconiosis, bronchial asthma
Machine engineering industry		
foundry (founders, cutters and formers)	Dust, containing free silicon dioxide, metal aerosol, irritating gases (sulfuric anhydride); hot microclimate; and temperature difference	Pneumoconiosis
welding production (electric and oxy-acetylene welding, cutter	Aerosols of metals, gases (nitrogen oxide and anhydrous hydrogen fluoride)	Pneumoconiosis, bronchial asthma, exogenic allergic alveolitis
Construction materials and construct industry (concrete mixers, borers and shot- firers)	Abrasive dust, metal dust	Pneumoconiosis, bronchial asthma
Textile industry and	Dust with free and bound	Biocenosis, bronchial

preliminary processing of fibrous technical cultures (operators of hackling machines and units, raw material sorters)	silicon dioxide	asthma
Plant growing (tractor and combine drivers)	Fibrous herbal dust, fungi and bacteria insemination	Pneumoconiosis, bronchial asthma
Cattle breeding (operators of poultry farms and animal farms)	Ground, plant gases, mineral fertilizers, and pesticides.	Bronchial asthma, exogenic allergic alveolitis
Feed production (operators and shift men)	Dust of herbal origin, biologically active matters (microelements), fungi and bacterial insemination	Bronchial asthma, exogenic allergic alveolitis
Bakery (elevator operators, millers and bakers)	Grain and flour dust, fungi insemination	Bronchial asthma, exogenic allergic alveolitis
Tobacco production (sorters of leaf tobacco, operators of cigar and cigarette machines)	Tobacco dust	Bronchial asthma

**Etiology.** The development of dust bronchitis depends in prolonged inhaling of much dispersed dust with small amount of quartz or even without it (cement, herbal, or wooden dust).

The appearance of disease is influenced by the presence of unfavorable conditions of production components: work conditions (microclimate, heavy work, or noise); a number of unprofessional factors (sex, age, smoking, infection in the past, or diseases of upper respiratory tracts).

**Pathogenesis.** In case of action of dust onto the body, disorder of some systems of protection of bronchi-pulmonary apparatus is observed, like mucociliary transportation, local immunity, and surfactant system. There are disorders of evacuation of dust portions and secretion function of bronchi on the background of structural changes of ciliary epithelia.

Dust bronchitis is characterized by atrophic and sclerotic changes in all the structures of bronchial tree, which form on the initial basis of the disease already, also by changes of bronchi motor activity, and hypersecretion.

In the pathogenesis of the disease, bronchospasm is very important. It appears in the result of reflector reaction of bronchial muscles onto dust particles or sensitization to allergens, contained in the industrial aerosol (chromium, manganese, nickel, phenol-formaldehyde resins, etc). Pathogenic microflora of respiratory tracts influences the development of the inflammatory process in bronchi and allergization of the patient.

At this disease, decrease of cell and humoral immunity decreases also, and significant meaning is also possessed by some genetic factors, in particular deficit of p1-inhibitor of the protease.

**Pathologic and anatomic pattern.** At dust bronchitis, bronchi, bronchial tubes and alveoli are affected. The action of dust first causes relevant reaction from the side of mucous tunic in the form of bronchi hypersection. Number of goblet cells

increases. Reological properties of mucus change, its viscosity is increased. Then cells of ciliary epithelia die, basal membrane, infiltration with lymphoid cells starts. This period is clinically determined as endobronchitis, or dust catarrh.

With time, endobronchitis transits into panbronchitis, and then into peribronchitis. Centers of infections in peribronchial cell are accompanied by perineal sclerosis and transition of inflammatory changes into parenchyma of lungs. This phase of reamed inflammation, which is along formation of various grades of sclerosis expression and obliteration of fine bronchi transits into the third stage - reconstruction.

Thus, evolution of chronic bronchitis can be presented by consecutive pattern of hypertrophic changes of bronchi with atrophic ones with further development of catarrhal mural deforming bronchitis. Spreading of inflammatory changes in distal sections of bronchial tree is accompanied by the violation of production of surface active matter - surfactant, which causes the development of bronchospasm and assists the appearance of severe complication - obstructive emphysema of lungs.

**Clinics.** After many years of work in contact with industrial dust, there is dry rales with some mucus appears. Gradually with years, it becomes stronger; dyspnea appears, as well as general worsening of health state. Worsening of the disease is rare and does not last long. During objective examination of the patient, there is clear pulmonary sound with box hint, mostly in lower portions of the chest. According to auscultative examination, breathing is coarse, dry and, sometimes, bubbling rales can be heard. No significant radiological changes are observed. Pulmonary insufficiency is absent, and within the period of acuteness corresponds to 0-1 degree. Changes in periphery blood are absent.

Later clinic manifestations of dust bronchitis in this stage of the disease are conditioned by a variant of bronchitis progress: obstructive, asthmatic, and inflammatory, which mostly depends on etiological factor. Thus, under the action of mostly quartz dust, as a rule obstructive bronchitis with lightly marked inflammation develops with fast developing emphysema of lung with obstructive genesis. Miners, electric welders, workers who are in contact with organic dust; mostly asthmatic variant of dust bronchitis develop. Presence of toxic components (metal oxide, formaldehyde, or sulphuric compounds) assists the development of bronchitis with manifestation of infectious process in bronchi, which reminds chronic toxic bronchi with the development of bronchoectases and pneumosclerosis. In such cases, frequent exacerbations are observed, with secretion of mucopurulent or purulent sputum, as well as corresponding changes of indications of clinical and biochemical blood analysis.

After the radiological examination, slow intensification of lung pattern, which at the period of exacerbation becomes more marked. Pulmonary decompensation of I or II degree. Initial symptoms of cor pulmonale can be observed. Exacerbations are longer (2 to 3 weeks), and their frequency is up to three times a year.

**Diagnostics.** Diagnostics of dust bronchitis is carried out in two stages: at first, it is envisaged to make a diagnosis of the chronic bronchitis as nosological form and definition of the degree of its severity, then dust etiology of bronchitis and thus occupational category of the disease.

The first stage of the diagnostic process is based on the record of clinical manifestations of the disease (anamnestic data, patient's complaints, results on physical examination) and auxiliary methods of research (functional, radiological and endoscopic ones).

When deciding on referring chronic bronchitis to an occupational disease, it is necessary to follow the following criteria:

1. Presence of sufficient stage of work under conditions of dust action (7 to 10 years and more). Work period under dust conditions should be supported by a corresponding written in a work record book of the patient.
2. Unfavorable conditions of work, supported by sanitary and hygienic characteristic (presence of dust on a work place with mentioning its concentration and composition), irritating gases, unfavorable microclimatic factors - changes of temperature, humidity and hard physical work).
3. Peculiarities of the development of chronic bronchitis - beginning and character of the disease development, presence of carried disease, especially pneumonia, described and proved by the extract from the outpatient record book of the patient.

Dust etiology of bronchitis is rather easily stated in the case when there is explicit development of the disease of bronchial and pulmonary system under conditions of the dust factor. Anamnesis indications of frequent diseases of bronchial and pulmonary system and much smoking can make the process of stating the professional character of the disease more complicated. But it is necessary to remember that in case of long work period, connected with the action of the production dust, in spite of the previous acute infections of respiratory breathing, it is difficult to exclude the impact of dust onto the development of chronic bronchitis. In case when a worker, whose past has an indication of acute bronchitis and pneumonia, but at the time of getting a job, which deals with dust factor, he/she was considered as healthy (what is indicated by a corresponding record), then was considered healthy and only in some time, he/she got chronic bronchitis, then this disease should be considered occupational as well.

When chronic bronchitis is a direct outcome of acute infection disease of respiratory organs, the issue on the connection of chronic bronchitis with the work conditions is solved individually first of all, with the consideration of work conditions and work period of the patient. Very often it is necessary to exclude unfavorable impact of production factors onto the development of the disease, which will enable to say about a joint genesis of hazard factors, first of all, dust and infections. In this case, they say about chronic bronchitis of the joint genesis (dust infection).

Based on complaints of the patient, changes, found during clinical examination, as well as presence of data from the listed above official documents, and differential approach diagnosis of dust bronchitis can be made.

When diagnosing dust bronchitis, it is necessary to determine the process activity. Dust bronchitis develops with periodic exacerbations, with which its progressing is connected, but these exacerbations do not manifest with clear indications usually, what shows the activity of pathological process. Such generally accepted indicators of the activity of the inflammatory process, as body temperature,

ESR, number of leukocytes, leukocytic blood formula, biochemical indicators (C-reactive protein, sialic acids, sulfur-mucoid, as well as haptoglobin), and during acute condition of bronchitis, they can be very unclear. That is why during the period of exacerbation, it is necessary to pay particular attention to the changes of clinical manifestation of the sick, reduction of their ability to work, sign of bronchospasms, weakness, increased diaphoresis, increased coughing, signs of bronchospasms, and appearing of mucopurulent sputum show the exacerbation of dust bronchitis.

With dust bronchitis, there is not always an opportunity to consider the dynamics of the process in two opposite phases - exacerbation and remission. Often after massive course of treatment in hospital, patients are released with some indications of delayed exacerbation. This condition should be considered as the stage of fading exacerbation, which envisages corresponding recommendations regarding the following outpatient treatment and regime. Sometimes, patients have clear clinical exacerbations, however some objective signs of bronchitis are increased (a threat of exacerbation). Corresponding job, and out-patient treatment) can prevent the appearance of exacerbations and loss of ability to work.

Thus, diagnostics of dust bronchitis is based on thorough recording of results of clinical and assisting research, career data and data on labor conditions.

**Treatment.** Tactics of treatment of dust bronchitis is based on the results of examination of patients and is conditioned by mostly symptoms, functional state of the external respiration, blood circulation, nervous and other systems, presence and explicitness of an allergic component, as well as the state of immune reaction.

Considering that at dust bronchitis, there is the development of atrophic processes in mucous tunic of the bronchial tree on the first stages of the disease; main treatment should be directed at the increase of general reactivity of the organism, stimulation of general regenerative processes in the mucous tunic of bronchi, as well as liquidation of bronchospasms.

First of all, it is necessary to tell about the utilization of means, which stimulate processes of epithelization. Such properties are possessed by methyluracil, which is given in the dose of 1 g 3-4 times a day after meals. It is also possible to prescribe 4 % solution of calcium pantothenate, which is given in the form of 4 % aerosol inhalation - 10 ml every day. The course consists of 10 to 12 inhalations.

Patients, who mostly have bronchospasms, are prescribed sympathomimetic agents: isadrin and novodrin, which are taken in the form of aerosols. Of some advantage are medicinal drugs of the same group in small dosated tanks: asthmopent, alupent, and berotek.

Optimal dose for inhalation is two inhaling, which are repeated 4 to 5 times a day. When treating patients with dust bronchitis with disorders of bronchial permeability, aminophylline is widely used - 2.4 % IV solution 10 ml dose.

When treating patients with dust bronchitis, medicinal drugs are used which improve phlegm discharge, like althaea root, termopsis herb, and potassium iodide, as well as means which have mucous solving action, like mucous solving inhalations and sodium chloride.

Considering the important role of an allergic component in the development of bronchitis, patients with this pathology are prescribed to use antihistamine

products, like Dimedrol, diazoline, and phencarol.

When treating patients with inflammatory version of dust bronchitis, main place is occupied by medicinal drug therapy, aimed at liquidation of inflammatory process and prevention of the process transfer into a chronic form. Infectious etiology of the given form of the disease is conditioned by utilization of a corresponding therapy (antibiotics, sulfanilamide, etc) with simultaneous conduct of measures to increase protective immunity of the body.

An important role in treating diseases of lungs are played by endobronchial sanitations with introduction of necessary medicinal drugs.

**Verification of the ability to work.** Issues of the verification of the ability to work for those, who have dust bronchitis, are solved individually, with the consideration of the severity of the disease, age, work period, occupation of the sick and work conditions.

**Preventive measures.** Main preventive measures of bronchitis is the conduct of technical, sanitary and hygienic measures, aimed at further improvement of the work environment for workers of dusty professions.

Measures of medical preventive measures, first of all, a quality conduct of medical examinations, both preventive and periodical, are very important. Another important preventive measure for dust bronchitis is timely and rather long treatment of acute inflammatory diseases of respiratory organs, active antismoking campaign.

