Bronchitis in children

Plan of the lecture

- 1. Definition bronchitis
- 2. Etiology
- 3. Bronchitis pathogenesis
- 4. Clinic groups of bronchitis in children
- 5. Bronchitis treatment

- **Bronchitis** is an inflammatory disease of bronchi mucous membrane with clinical presentation of cough, sputum production, dyspnea in case of small bronchi affection

Problem is actual due to

- - Frequent morbidity
- -Frequent complication of pneumonia
- -Tendency for recurrent and complicated course
- -Predisposing for atopic reactions with further formation of obstructive forms, bronchial asthma
- -High financial demands for treatment

Predisposing factors

- - Nose congestion (due to narrowing of nose ways, anatomic disorders of nasal septum
- Focuses of infection in upper respiratory tract (rhinitis, sinusitis, tonsillitis)
- Immune response abnormality (immaturity of immune system in infants and toddlers
- Co-morbidities (allergic rhinitis, sinusitis, laryngitis)
- Passive and early active smoking, toxicomania
- Carriage of provisional microflora in respiratory tract
- Unfavourable weather (high humidity,, deviations in surrounding temperature etc)

Etiology

There are 3 groups

- **Infectious bronchitis (viruses, bacteria, atypical microorganisms, fungus, protozoal)**
- **Noninfectious, due to influence of various allergens, toxic substances, physical factors on mucous membrane**
- **Mixed etiology influence of infectious factors as well noninfectious**

Infectious bronchitis

- **Viral** –typical for predominant acute and recurrent forms of disease (65-90%). More frequently are influenza, parainfluenza, rhino-syncitial, adeno-, rhino-, corona-, rota- entero- viruses

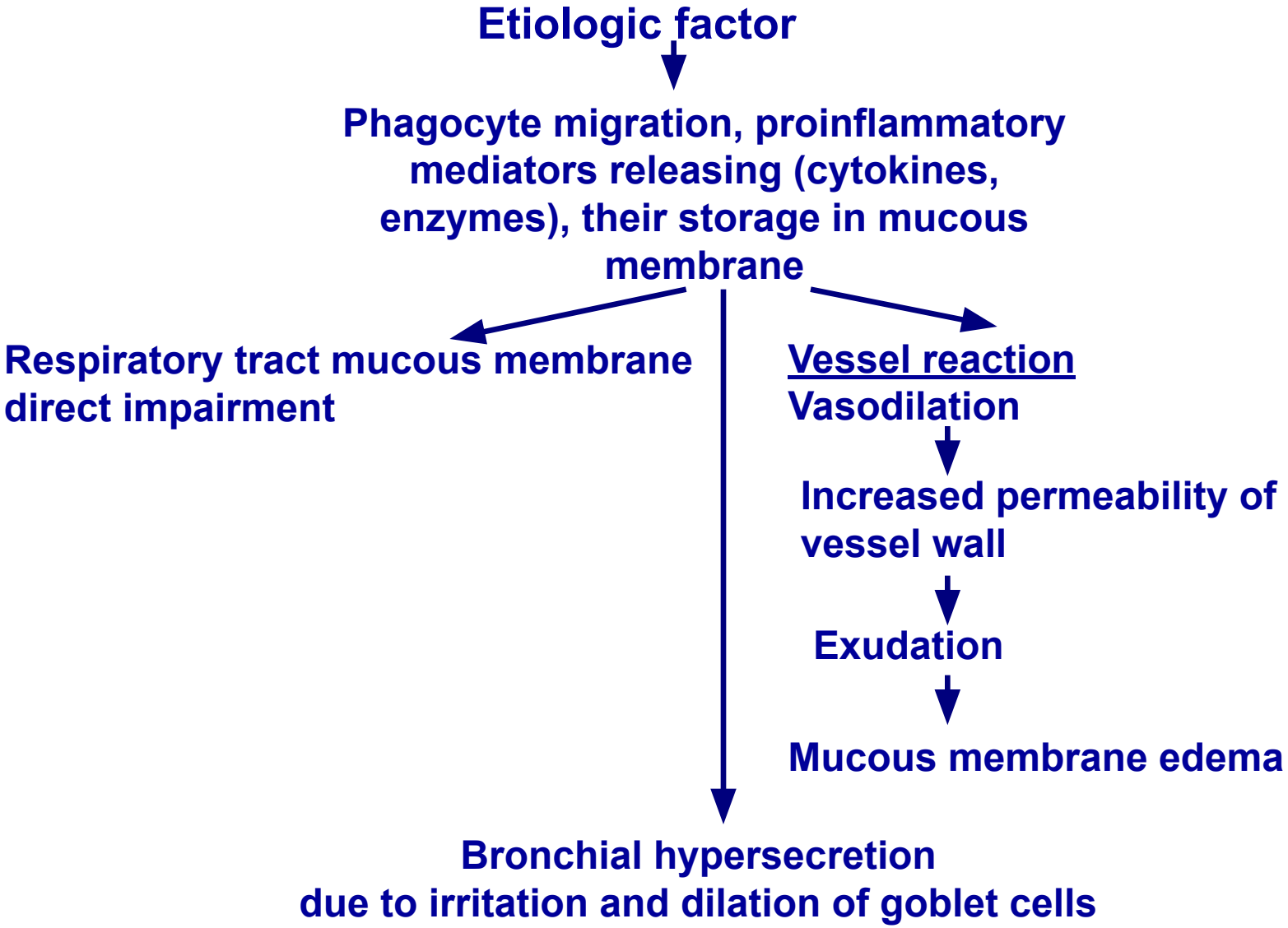
Bacterial bronchitis are usually complications of viral process in respiratory tract

The main bacterial causative factors of bronchitis in children (data of Geraschenko T.I., 2002)

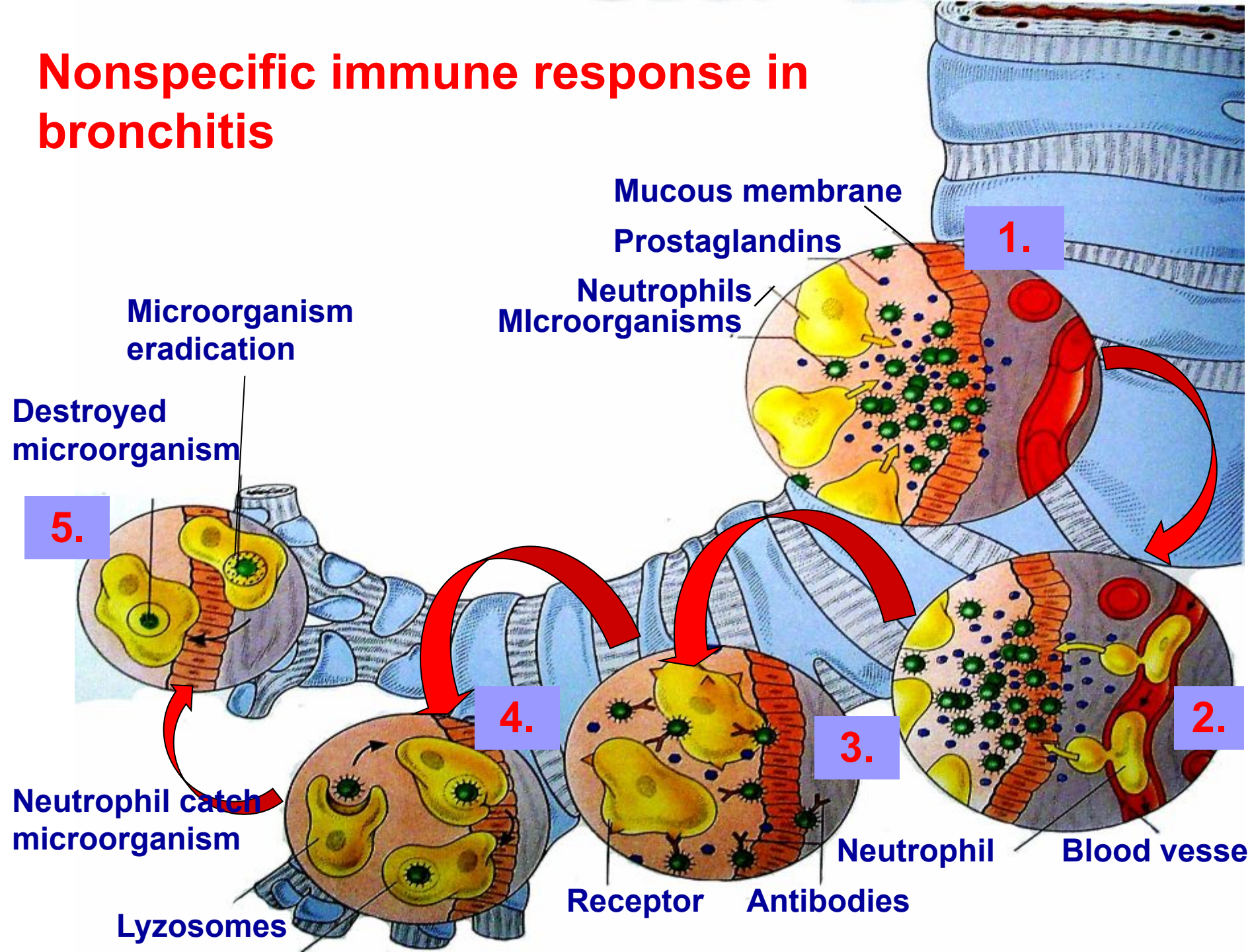
Streptococcus pneumoniae	+++
Streptococcus viridans	+
Klebsiella pneumoniae	++
Haemophilus influenzae	+++
Moraxella catarrhalis	+++
Staphilococcus aureus	+
Mycoplasma pneumoniae	++
Chlamidia pneumoniae	+

The most significant are Candida, Aspergillus among fungus infection

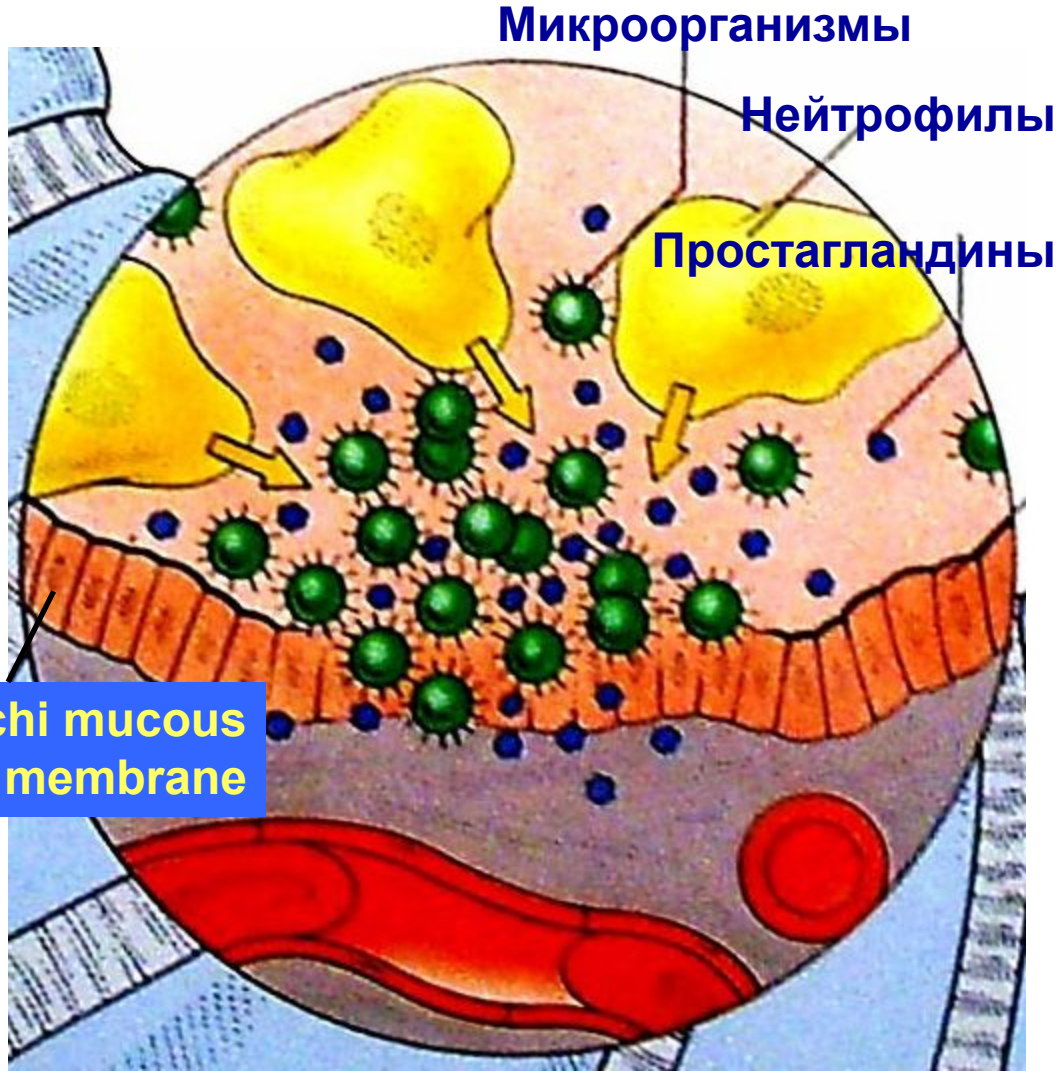
Bronchitis pathogenesis



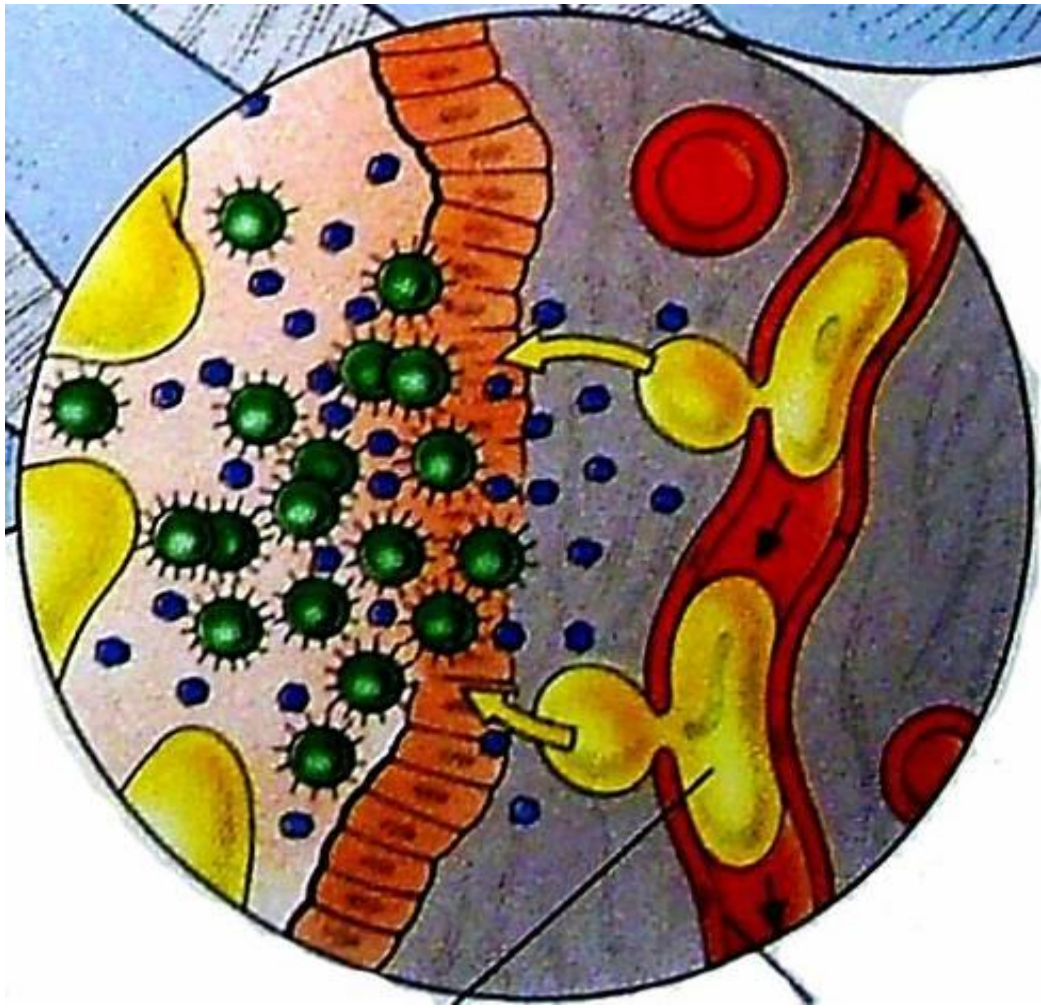
Nonspecific immune response in bronchitis



1.Pathologic microorganisms damage local tissues and stimulate releasing of prostglandins and hystamine. They cause edema, pain and attract neutrophils and another effector cells



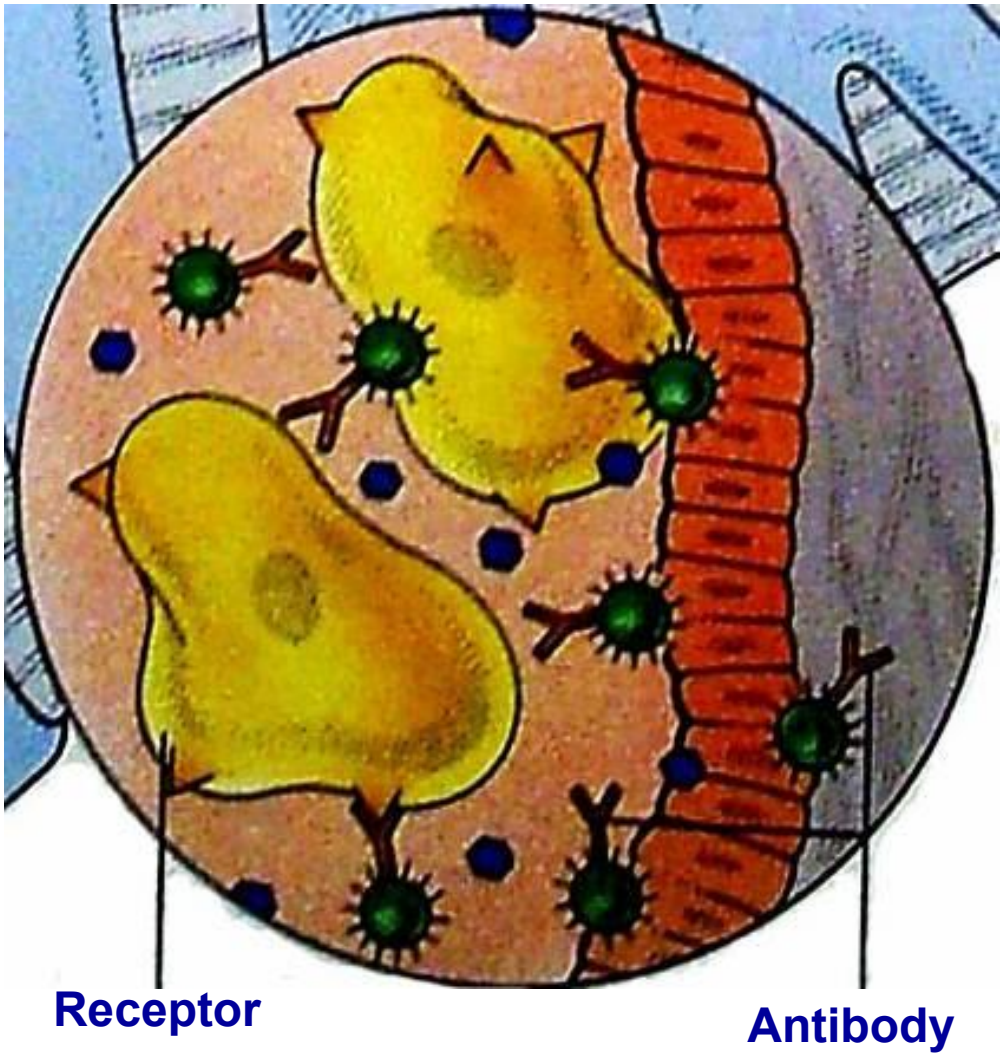
2. **Microorganisms release toxins, stimulate neutrophils' permeability from circulation (neutrophils by diapedesis penetrate through pores in vessels' endothelium and direct towards affected site)**



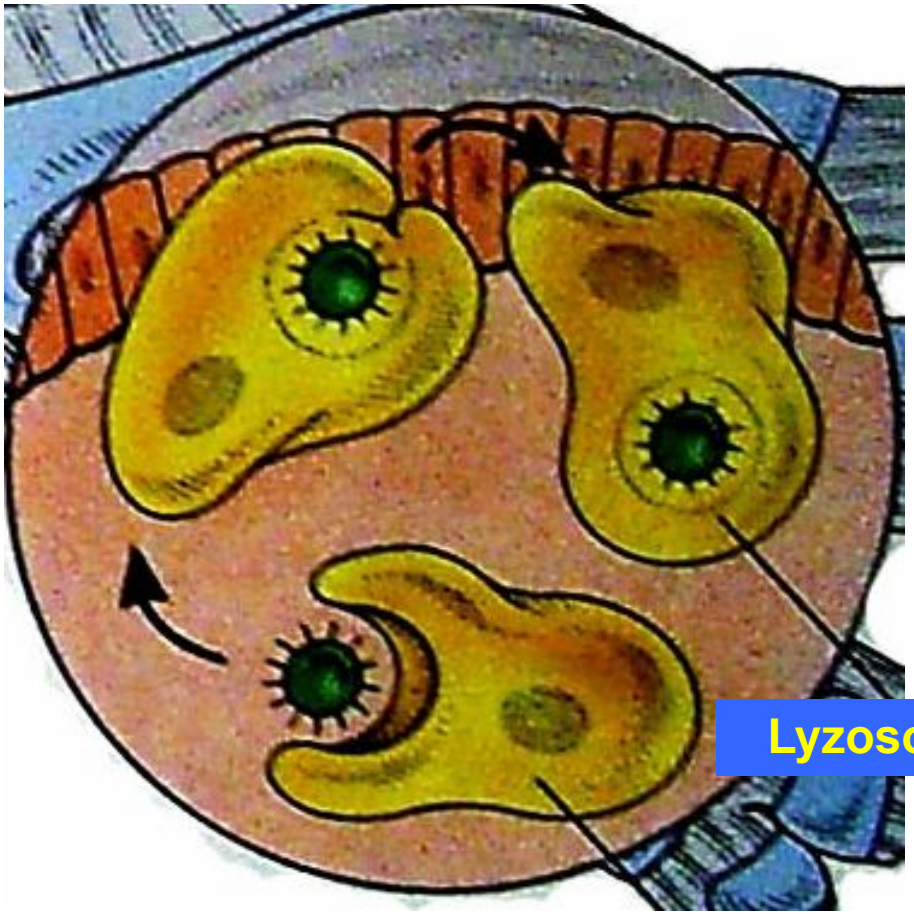
Neutrophil

Blood vessesl

3. **Antibodies are special proteins that can attach to microorganisms. New neutrophils has receptors to recognize antibodies and pathogens and they also attach to complexes**

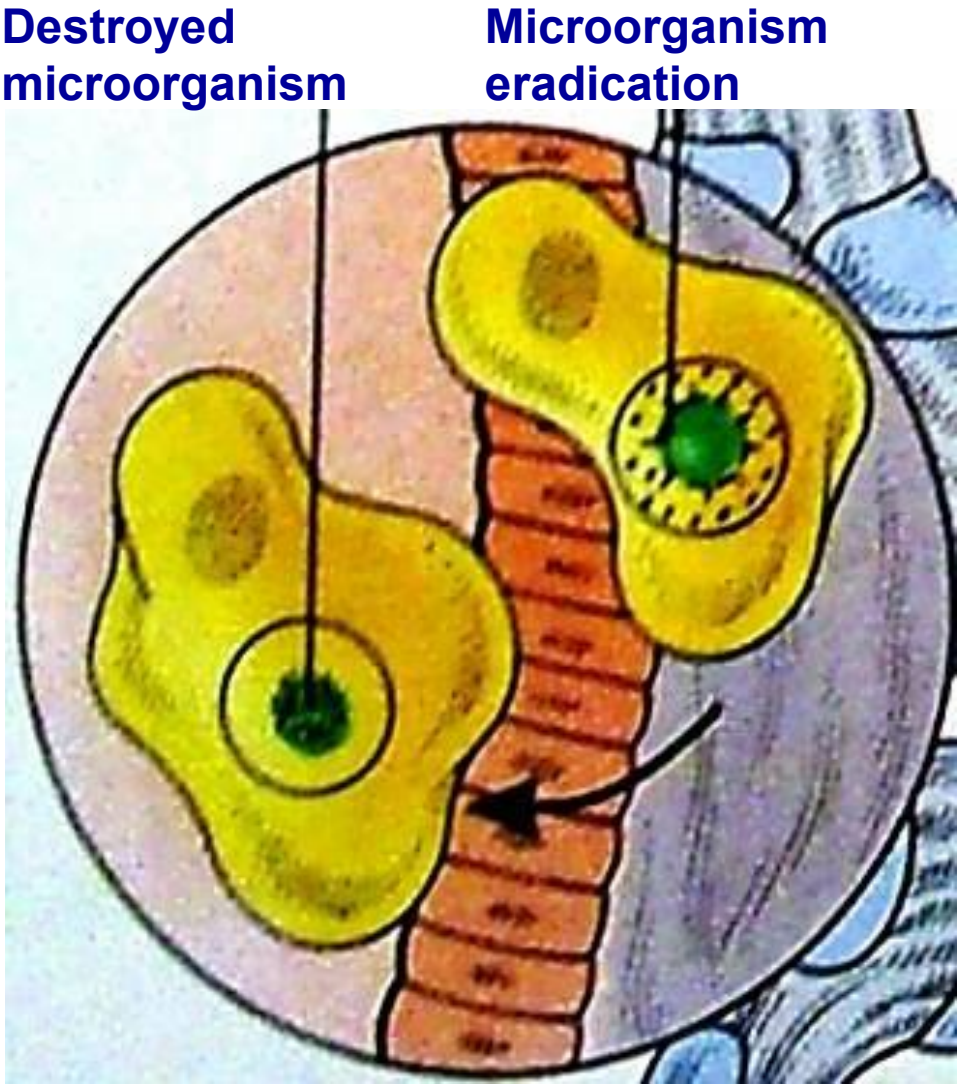


4. **Neutrophils create pseudopodias and absorb pathogens by this structures. Digestion of microbes is performed by enzymes in phagolyzosomes (i.e. phagocytosis is performed)**



Neutrophil captures microorganism

5. **Microorganisms are destroyed. Remnants of pathogens can be excreted on cell membrane**



Changes of bronchi in bronchitis

1

2

These are pictures of healthy normal bronchi (1) and bronchus in bronchitis (2), bronchial lumen is narrow

Bronchitis diagnostics

All clinical symptoms can be divided for

- **Main constant** (**cough, production of sputum)**
- **Additional, transient** (**rales, obstructive syndrome, dyspnea)**

Cough is a “guard dog of bronchi”

- **Complex reflectory mechanism that protects respiratory tract and remove foreign bodies or pathologic material, excess of sputum from bronchi and maintain bronchial patency**

Any inflammatory process in respiratory tract impairs mucociliar clearance due to

- Partial loosing of cilia epithelium in bronchi
- Impairment of secret moving
- Secret layer increasing
- Raising secret viscosity
- Secret accumulation in various parts of respiratory tract

Clinic groups of bronchitis in children

Pathogenesis

- Primary
- Secondary

Etiology

Infectious

- Viruses
- Bacterial
- Mixed (viral, bacterial)
- Fungus

Noninfectious

- Allergic factors
- Chemical factors
- Physical factors
- Smoke

Mixed

due to infectious and noninfectious factors

Clinic groups of bronchitis in children

Course

- Acute (not more than 2-3 weeks)
- Lingering (more than 3 weeks to 1 mo)
- Recurrent (repeat more than 3 times per year, phase of exacerbation and remission)

Clinic type

- Simple (nonobstructive)
- Obstructive

Affected level

- Tracheitis
- Tracheobronchitis
- Bronchitis
- Bronchiolitis

Tracheitis(J 04.1)

- Trachea mucous membrane inflammation as a result of acute respiratory disease of viral etiology
- Disease can be accompanied by inflammation of larynx (Laryngotracheitis, J 04.2) or in bronchi (Tracheobronchitis, J 20)

Acute simple bronchitis (J 20- J 20.9)

- Acute bronchial mucous membrane inflammation predominantly is caused by viral infection
- Symptoms of viral intoxication: common condition impairment, chills, decreased appetitie, behavioral changes of child, flaccidity, weakness or excitability, impairment of sleeping, fever, head ache, transient muscle pains, catarrhal events in nasopharynx
- Symptoms of bronchitis: cough, sputum production, formation of rales, dyspnea
- Physical examining: percussion and palpation without changes
- Auscultative changes: rough bronchial sound, prolonged expiration, bilateral rales in various parts of lungs changes after cough
- Hemogram changes: elevated ESR while normal or decreased leucocyte count
- Chest X-ray: enhancing of bronchial linearity, root shadow is wide, not clear

Obstructive bronchitis (J 20)

Special clinic type of disease with bronchial obstructive syndrome due to inflammatory decreasing of bronchial aperture

Diagnostic criteria

- **Common condition impairment, rhinitis symptoms, nasopharyngitis, catarrhal symptoms**
- **Body temperature normal sometimes subfebrile, rarely hyperthermia**
- **Manifested respiratory failure**
- **Signs of bronchial patency abnormality**
- **During percussion: tympanic sound**
- **Auscultation – rough bronchial sound, prolonged expiratory sound, moist bubbling rales, during expiration dry whistling (wheezing) rales**
- **Manifested tachycardia**
- **X-ray picture - intensification of vascular picture, increased clearance of lungs due to emphysema, amplification of bronchial picture**

Factors of bronchial asthma development

- Recurrent obstruction (three and more episodes of obstruction)
- Atopy inheritance
- Obstruction is initiated by contact with allergens of noninfectious nature
- Proved dust, epidermal and other types of sensibilization
- Co-morbidities: another allergic diseases like atopic dermatitis, allergic rhinitis, conjunctivitis
- IgE level I blood is more than 100IU/l

•Bronchoscopic picture in obstructive bronchitis; in aperture of left main bronchus solid sputum clot is visualised

Bronchiolitis (J-21 – J 21.9)

Acute generalized obstructive disease of distal respiratory tract – terminal bronchi

Disease develops only in infants

Clinical peculiarities of bronchiolitis

- **Progressive dyspnea**
- **Nonproductive cough**
- **Manifested signs of severe bronchoobstructive syndrome**
- **Signs of respiratory failure**
- **Another organs and systems reactions (cardiovascular syndrome, hypoxic changes of CNS)**
- **Percussion tympanic resonance**
- **Auscultation bilateral manifested respiratory sound attenuation, expiratory sound isn't audible. In basal part of lung crepitation or bubbling sound on the ground of attenuated breathing sound, special "inspiratory" peep is audible**

Chronic bronchitis (J 40-J 42)

Disease is characterized by episodic or constant cough and sputum production for 2 or more years, summary duration of productive cough is more than 3 mo per year

Diagnostic criteria of chronic bronchitis in children

- **Prolonged pulmonologic anamnesis**
- **Stable clinic signs, impaired tolerance of physical loadings, changed shape or deformities of chest, thickening of distal phalangs and nails**
- **Stable (local or spread) physical changes in lungs**
- **Radiologic signs “Solidified” X-ray picture with emphysema signs, pneumofibrosis, manifested deformity of lung picture**
- **Deformity of bronchi**
- **Stable, sometimes progressive respiratory function impairment**

Bronchitis treatment

Indications for hospitalization

- Severe course of bacterial bronchitis, manifested signs of intoxication
- Complicated bronchitis – with manifested mucus retention, impaired bronchial patency, atelectasis formation etc.
- Bronchiolitis (in children of less than 1 y.o. because of threatening of emergency conditions)
- Severe types of Obstructive bronchitis (OB) – especially resistant for treatment in ambulatory conditions
- Lingering and recurrent bronchitis (for diagnostic and treatment)
- Chronic forms of disease (for treatment and full examining)
- Bronchitis on the ground of another somatic severe diseases (CNS, anomalies and malformations of organs chronic disorders
- Social reasons

Bronchitis treatment

- Regimen: special regimen isn't necessary but more proper home regimen for all acute period
- Diet: must be rational rich in vitamins
- Medical treatment:

✔ Etiotropic

✔ Pathogenic

Etiotropic treatment in bronchitis

1.Antiviral treatment

Indications for antiviral medication:

- In moderate and severe courses of viral infection accompanied by bronchitis
- In children with respiratory support
- For bronchitis prevention in group of frequently and severe ill children
- For prophylaxis and treatment of premature children
- In complex treatment of recurrent bronchitis
- For prophylaxis of chronic bronchitis exacerbations

Etiotropic bronchitis treatment

Antiviral treatment

Medications

- Remantadin
- Algirem
- Arbidol
- Amixin
- Ribavirin
- Tamiflu (ozeltamivir)
- Aflubin

Etiotropic bronchitis treatment

Antiviral treatment

Interferons

- Human Leucocyte Interferone (IFN-alfa)
- Reaferon (recombinant alfa-IFN)
- Viferon
- Gripferon

Inductors of Interferons

- Cycloferon
- Neovir
- Poludan

Etiotropic bronchitis treatment

2. Antibacterial treatment

Indications for prescribing antibacterial treatment

- Fever (T> 38C for more than 3 days), especially in infants
- Intoxication signs
- Purulent sputum production together with intoxication
- Presence of chronic focus of infection together with bronchitis (purulent otitis, rhinitis, sinusitis, lymphadenitis etc)
- Lingering (more than 2 weeks) or recurrent course of disease
- Premature child or infants of first 6 mo old with law indexes of health
- Unfavourable premorbid phone of disease
- Chronic bronchitis exacerbations with clinic indexes of bacterial infections
- Hospital bronchitis

Etiotropic bronchitis treatment

2. Antibacterial treatment

Antibiotic treatment approach

- Choice of start antibiotic
- Choice of proper medication delivery (oral, IV way)
- Choice of effective antibiotic is performed empirically taking into account more probable causative factor according to site of infection (community acquired, hospital), patient age, premorbid phone, severity of bacterial process

Etiotropic bronchitis treatment

2. Antibacterial treatment

Medications of choice

- **Aminopenicillines with β –lactamase inhibitors** (amoxiclav, augmentin)
- **Cephalosporines I-III generations** (cephazoline, cefalexin, Cefaclor, cefuroxim, cefotaxim, ceftriaxone)
- **Macrolides** (azitromycine, clarythromycine) alternative medications (in case of β-lactams antibiotic intolerance)
- In case of local inflammative process (laryngotracheitis, tracheitis, tracheobronchitis) – topical antibiotic (**bioparox-fuzenzhin)**

Pathogenic bronchitis treatment

Principles of treatment

- Respiratory tract mucous membrane inflammation suppression
- Normalization of secretory aparatus and mucociliary transport functioning
- Control of cough reflex
- Restoration of bronchial patency (bronchial obstruction elimination)

Pathogenic bronchitis treatment

Antiinflammatory treatment

Erespal (Fenspirid) – **perform multiple action on inflammation, action is similar to corticosteroids but without side effects typical for steroid therapy**

Effects of Erespal

- **Influence of vessel and cell components of inflammation that decrease permeability of vessels exudation and edema**
- **Partial blockage of α-adrenoreceptors that decrease hypersecretion of sputum**
- **Influence of bronchial patency due to spasmolytic action on smooth muscles and improvement of mucociliar clearance**
- **Antagonist activity o H-1 hystamine receptors, decreasing synthesis and inhibition action of hystamine**
- **Decreasing of leucocyte infiltration**
- **Nondirect influence for cough intensity**

Pathogenic bronchitis treatment

Secretory function and mucociliary transport normalizing

All medications that influence to these processes can be divided into 6 main groups

- **Mucokinetics or expectorant**
- **Respiratory tract secret rehydrant medication**
- **Mucolytics or medications that directly influence on secret rheologic properties**
- **Mucoregulators**
- **Medications that stimulate lung surfactant production**
- **Antipertussis medication**

Pathogenic bronchitis treatment

Secretory function and mucociliary transport normalizing

Mucokinetics – expectorant (secret-motor) medications

- **Mucaltin**
- **Bronchicum**
- **Tussin**

Pathogenic bronchitis treatment

Secretory function and mucociliary transport normalizing

Resorbtive medications- respiratory tract secret rehydrants

- **1-3% water solutions of sodium and potassium iodides (1 teaspoon -1 big spoon after feeding with big quantity of water)**
- **0,5-2,5% ammonium chloride water solution (1teaspoon-1big spoon 5-6 times/per day after feeding with big quantity of warm water)**
- **1-2% sodium hydrocarbonatis water solution per os or for inhalations**

Pathogenic bronchitis treatment

Secretory function and mucociliary transport normalizing

- **Secretolytics – medication that regulate secret rheological properties**

Nondirect activity	
Change biochemical mucus composition or production	S-carboxymethylcystein, sorbeol, bromhexinum
Change adhesive properties of gel layer	ambroxol, sodium bicarbonatis
Influence on zole layer and rehydration	water, sodium and potassium salts solutions
Volatile substances and balsams	terpens

Pathogenic bronchitis treatment

Secretory function and mucociliary transport normalizing

- **Secretolytics**

Direct action		
destroy polymers of mucus	Tiols	Cystein, acetylcystein, pyopronin, mesna
	Enzymes	trypsin, β-chemotrypsin
	Other	Ascorbic acid, hypertonic NaCl solution, nonorganic iodides

Pathogenic bronchitis treatment

Secretory function and mucociliary transport normalizing

Medications that regulate secret production and its rheologic properties (carbocystein derivatives)

- **Fluditec (carbocystein)**
- **Fluifort(Carbocystein salt of lysine)**
- **Mucodin (D-carbocystein)**
- **Mucopront (Carbocistein)**

Pathogenic bronchitis treatment

Secretory function and mucociliary transport normalizing

Mucoactive medications (that improve rheologic properties and influence on surfactant synthesis)

- **Ambrohexal (ambroxol)**
- **Ambrosan (ambroxol)**
- **Lasolvan (ambroxol hydrochloride)**
- **Ambene**
- **Cholycsol**
- **Bisolvon**

Pathogenic bronchitis treatment

Secretory function and mucociliary transport normalizing

Mucoactive medications pharmacological properties

- Mucoregulation
- Mucolytic
- Secretomotor effect
- Elimination, connected with increased mucus fluidity and its expectoration
- Metabolic – activation of alveolar surfactant
- Antiinflammative and immunomodulative action
- Lung protection from oxydative stress and decreasing of bronchi hyperreactivity
- Partial suppression of cough reflex

Pathogenic bronchitis treatment

Secretory function and mucociliary transport normalizing

Antipertussis medication – predominant effect is suppressing of cough reflex

Peripheral action

- **lybexin, tussuprex, levopront**

Central action

- **Narcotic medication**
  - **codein, dionin**
- **Nonnarcotic medication – synecod, glauvent, tusuprex, sedotussin**

Bronchitis prophylaxis

- Organism tempering
- Vaccination against ARD
- Infectious focuses eradication
- Sanatorium treatment

Questions

- Acute bronchitis in childhood.
- Classification bronchitis.
- What causes acute bronchitis?
- Clinical forms bronchitis.
- Acute obstructive bronchitis and recurrent bronchitis Bronchiolitis.
- Clinical manifestations. Diagnosis.
- Can medicine treat acute bronchitis?
- Antiviral treatment.
- Will antibiotics help acute bronchitis?
- Rational antibiotic and hormone treatment.
- What about oxygen therapy?
- Immunotherapy.
- Physiotherapy.
- Therapeutic bronchoscopy.
- What can I do to help my breathing and reduce my coughing?