

Pneumonia: new diagnostic approaches

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Pneumonia belongs to the most frequent acute top respiratory ways diseases (after respiratory virus); it takes the third place with its prevalence and the first place with disease incidences (60 %) among all the breath organs diseases. The prevalence of pneumonia among the adult population grows, especially among the persons after 50 years and makes up 1700 of 100000 persons.

The pneumonia is an acute infectious disease of mainly bacterial nature described by focal affectation of respiratory departments of lungs with intraalveolar exudation, detected by physical or instrumental investigation (more often by radiological one), and also by feverish reaction and intoxication expressed in various degrees. The pneumonias take the 4th place among the reasons of death after cardiovascular diseases, malignant new growths, traumas and poisonings. The greatest number of death cases because of pneumonia falls on patients of more than 80 years [1].

Classification

1. By etiology:

- Bacterial pneumonias: streptococcal, staphylococcal, pneumococcal pneumonias;
- Viral pneumonias;
- ricketsiosal pneumonias;
- mycoplasmal pneumonias;
- Mixed pneumonias with association of activators;
- pneumonias due to the influence of physical factors: overcooling, high temperature;
- pneumonias due to the influence of chemical factors: petrol, dust, oxides of nitrogen, dioxide of sulfur, sulfuric acid, etc.
- postoperative patients' pneumonias due to the penetration of foreign bodies, etc.
- Clinicomorphological classification (after I.S.Molchanov)
- Mainly parenchymatous: croupous pneumonia, bronchial pneumonia;
- interstitial pneumonia;
- Mixed pneumonia.

2. By clinical course:

- With an usual cyclic course: beginning - development - resolution;

· Prolonged course. In 10 % of cases the pneumonia has its prolonged course and can turn into a chronic one.

3. One differs also the following kinds of pneumonia [5]:

- Community-acquired pneumonia
- Nosocomial pneumonia (hospital-acquired)
- Aspiration pneumonia
- Pneumonia of persons with heavy immunity defects (congenital immunodeficiency, HIV-INFECTION, iatrogenic immunosuppression)

To the occurrence of pneumonia promote:

- microflora entering from the top departments of respiratory ways, from the environment or from other organs,
- disordered secretory functions of bronchial tubes and fibrillating epithel (influence of toxins, a chronic pathology of respiratory ways, disordered lung hemodynamics,
- « stereocilia syndrome »),
- Decreasing of cellular and humoral immunity (phagocytic activity of leukocytes, complementar, lysozym and bactericidal activity of serum, concentration of immunoglobulin, T-lymphocyte and their proliferative activity, antibody formation) [2,3,4]

The pneumonia **diagnosis** is made on the ground of anamnesis data, of data obtained with clinical, radiological, laboratory and other investigation methods [1]:

- **The anamnesis.** Such facts, as overcooling, stress, an acute respiratory disease, previous to the beginning of the disease, an epidemiological situation in the family or in the collective (if the pneumonia caused by endocellular pathogens is suspected), a probable aspiration, any stomatologic manipulations shortly before beginning of the given disease, are important. A special attention must be paid to the patients with congenital or acquired immunodeficiency, to the patients, who has been taking glucocorticosteroids and cytostatics for a long time, and also to the patients suffering from chronic breath organs diseases, from decompensation of heavy accompanying diseases, such as arterial hypertension, ischemic cardiac disease, chronic renal and hepatic insufficiency. Staying in a hospital, especially in reanimation department, an artificial lung ventilation are high risk factors of hospital pneumonia development.

The body temperature can rise from subfebril to febril with a possible rigor. The temperature of weakened patients, of elderly persons and persons suffering from immunodeficiency can stay normal. The cough can be of different intensity: unproductive at the beginning of disease, further with expectoration. A plenty of sputum, especially of purulent one, testifies to destruction of lung tissue. The cough can be accompanied by blood spitting. The pleural pains can be on the side of affection. The occurrence or amplification of dyspneu of before is possible. The

symptoms of intoxication with different expressiveness degree: unmotivated fatigability, decreased appetite, nausea, hyperhidrosis.

Some patients have mainly extrapulmonary manifestations: mental confusion or desorientation, abdominal pains, for example. Elderly persons, and also the persons suffering from alcoholism or granulopenia, the lung semiology can be absent in general, and the diagnosis can be made according to the results radiological examination.

-Physical attributes of lung tissue consolidation: shorting of percussion sound, restriction of lung edges mobility, strengthened voice trembling, changed breath (weakened, rigid, bronchial), fine moist rales or crepitation in the zone of affect, pleural friction rub is possible. About 20 % of patients can have no physical attributes of pneumonia at all. An important feature of the majority of community-acquired bacterial nature pneumonias is an unilateral affection. The primarily bilateral community-acquired pneumonias can be met extremely seldom. The presence of symmetric symptoms (rales or crepitation) can mean a virus affection of bronchial tubes and/or of interstitial lung tissue, left ventricle insufficiency, a debut of fibrosing alveolitis.

- Radiological attributes of pneumonia - one of the most significant attributes for verification of the diagnosis. Roentgenography is the most important and an irreplaceable investigation method to confirm the clinical pneumonia diagnosis. Thus it is necessary to emphasize, that photoroentgenography and roentgenoscopy cannot replace the roentgenography. A good quality roentgenogram of thorax being made in the beginning of disease, can be used as a documentary confirmation of breath organs and cardiovascular system state at the moment of examination and further it plays an important role when doing a dynamic supervision during the treatment.

If pneumonia is suspected, the roentgenography of the thorax is to be carried out in direct and lateral projections. A typical radiological attribute of pneumonia is lung tissue shadowing which can be focal, confluent, segmentary (polysegmentary), lobar or even more widespread. So-called "central" or "radical" pneumonias practically can't be met, and a similar radiological conclusion can be made exclusively when the lungs are examined only in direct projection where the shadowings in the third and sixth segments are projected on the root area. It is extremely important in the practical meaning, to distinguish infiltrative changes, peculiar to pneumonia, and edema of lungs intersticium, characteristic for virus affections, for disordered hemodynamics of small blood circulation circle of cardiogenic genesis. The radiological changes under existing conditions more often are characterized by bilateral localization and consist in expansion and fogging of roots of lung, in amplification of vascular figure, in occurrence of Kerli-lines above the diaphragm. The value of roentgenography of thorax organ consist not only in the fact of pneumonic infiltration visualization, i.e. in the verification of diagnosis when having other clinical attributes, in the estimation of therapy efficiency. The changes on the

roentgenogram (prevalence of infiltration, presence or absence pleural exudate, cavities of destruction) specify the heaviness of disease, help in a choice of antibacterial, symptomatic therapy and other (pleural puncture, for example) treatments.

- **Sectional roentgenography computer tomography** (with the sensitivity 2 times higher, than roentgenography's one) - under indications.
- **Changes in the clinical analysis of blood:** leukocytosis (30-50 % of patients can have no leukocytosis) more than $10-12 \times 10^9/l$, shift of leukocytal formula to the left - with the first days of disease, toxic granularity of neutrophils, acceleration of ESR - by the end of the first week.
- **Biochemical analysis of blood.** The results of the biochemical analysis of blood are not of decisive importance for making pneumonia diagnosis, but they are necessary to estimate the clinical situation as a whole, to except the possible complications due to other organs and systems
- **Sputum analysis** – the coloring of sputum smear according to Gram. The sputum samplings are preferred to be taken before the beginning of antibacterial therapy. The results of microscopy give a reference point for prescribing an antibacterial therapy against gram (+) or gram (-) flora. This investigation has the greatest diagnostic value for identification of pneumococcus, under the condition that it will be done prior to the beginning of antibacterial therapy.
- **Ethiological diagnostics of pneumonias.** In the clinical practice the ethiological diagnostics of a pneumonia is carried out, as a rule, under the conditions of a hospital with using the following methods:
 - * Microscopy of smear,
 - * Discharge of pure culture of the activator from the center of infection and from the blood,
 - * detection of seroconversion,
 - * detection of activator's antigenes,
 - * detection of nucleic acids of microorganisms.

For verification of pneumonias caused by endocellular pathogene (chlamydia, mycoplasma, legionella) so-called incultural methods are applied. To confirm the mycoplasma, chlamydia, legionella or cytomegalovirus nature of pneumonia, the serologic researches of paired serums with the interval of 10 and more days can be carried out after a significant (4 and more times) increasing of antibody titer.

The specific antibodies to these activators can be also defined with the help of indirect immunofluorescence reaction.

The serologic methods of diagnostics are used for retrospective diagnostics of pneumonia activators and this is not so actual for clinical practice, but it is important for carrying out of populational epidemiological investigations.

Now the method of legionella antigenes detection in urine of patients is widely used abroad. Its high sensitivity and efficiency is proved, especially when applied

in intensive therapy and reanimation departments. But the recommendations for its application in Russia are not formulated yet.

The detection of nucleic acids of microorganisms is applied when it is necessary to identify the endocellular bacterial pathogens - mycoplasmas and clamidia. The methods of hybridization and amplification are being used. The method of amplification is a high-sensitivity expressdiagnostics method, on its basis some commercial tests – systems are developed, including domestic products. However they have found no application in the wide clinical practice till now because of its dearness and labour-intensiveness.

- **Discharging of hemoculture** in case of pneumonia takes place in not more than 10% of cases, thus it is marked, that the sowing ability of microorganisms is 2 times reduced on the background of antibacterial therapy, and when having a heavy clinical course of pneumonia it grows by 30 %, on the contrary. If the patients have their hemoculture discharging, the forecasting of pneumonia becomes more difficult, especially if they are elderly ones.
- **Ultrasonic examination**, when having pleural friction rub, allows to specify even small (up to 400 ml) amounts of exudate, which not always can be determined by usual radiological examination.
- **Examination of pleural liquid** (cytologic, bacteriological, detection of protein, inoculation of flora , including the tuberculosis mycobacteria inoculation, detecting of atypical cells) is an important diagnostic help in case of diagnostic complexities, of an inefficient therapy.
- **Detecting of blood gases** at patients having clinical attributes of respiratory insufficiency caused by distributed pneumonic infiltration, of massive pleural exudate accompanying by chronic obstructive pulmonary disease, etc. The examination of arterial blood should be preferred since the corresponding parameters of gas structure of capillary blood are of smaller diagnostic value, and they do not objectively reflect the parameters of arterial blood gases. Thus the hypoxemia with decreasing level of partial oxygen tension of lower than 60 mm of mercury column can be considered as a bad prognostic sign indicating that the patient must be taken into intensive therapy department.
- **Invasive methods of diagnostics**
The fiber-optic bronchoscopy with a quantitative estimation of microbic shoots of the received material ("protected" brush-biopsy, bronchoalveolar lavage) or other methods of invasive diagnostics (transtracheal aspiration, thoracoscopic biopsy) are carried out, if indicated, for patients who have pneumonia and pathology of immune system, if there are suspicions on lung tuberculosis, if a productive cough is absent, in case of obstructive (tumoral)pneumonitis, in case of foreign body aspiration.

Thus, the diagnosis of pneumonia is based on a complex of clinicoradiological and laboratory data with taking into account the accompanying pathology and with excepting of others similar symptocomplexes.

- **Bioresonant testing** by a new experimental technique with using of “Biolaz-Oberon 11S” complex is offered as an alternative method of pneumonia diagnostics.

With the hardware complex "Biolaz-Oberon" [6] we have tested 43 patients with clinically made pneumonia diagnoses of various localization. The opportunities of the method are shown below.

Figure 1. This figure shows the cartograms of patient R., 43 years, practically healthy, not having any complaints concerning the breath organs. The overwhelming majority of markers correspond to a healthy tissue.

Thorax organs Trachea and bronchial tubes Right lung

Left lung Lungs and pleura Lung tissue

Figure 2. This figure shows the cartograms of patient P., 37 years, having complaints about the cough with difficult discharging sputum, weakness, hyperhidrosis, the temperature of 38,5 within 2 days. Physical signs – deadened sound in the right infrascapular region, rales in the same place are listened. Roentgenological the shadowing in the bottom part of right lung comes to light. The clinical diagnosis - right-hand bottom lobar pneumonia. On the showed cartograms in the field of the bottom part of bronchial tree on the right and on the cartogram of the right lung the markers corresponding to an expressed pathology are clear visible.

Trachea and bronchial tubes Right lung

Figure 3. The given cartogram belongs to patient D., 48 years, having complaints about the subfertil temperature within 3 weeks, appeared on the background of sharp respiratory disease, weakness, hyperhidrosis. Physical signs – isolated rales are listened in the left infraclavicular region. Roentgenological little shadowings are visible in the top part of the left lung. The bacteriological sputum analysis to detect the Kokh-bacillus is negative. The clinical diagnosis - pneumonia with localization in the top part of the left lung. On the submitted cartograms the pathological markers are placed in the top part of the left lung

Thorax organs Left lung

Figure 4. This figure shows the examination results of patient K., 35 years, who has addressed the medical center because of an expressed dyspnea, of an quick dry cough, of extreme weakness. The patient got ill in a train after a long overcooling. Physical sign - temperature 39, 2. The breath is weakened on two sides, above the lung is marked a bilateral deadened sound, acrocyanosis. A bioresonant testing has been done, its results were used to place markers on the cartograms corresponding to trachea and bronchial tubes, to the cut of bronchial tubes, to the left and to the right lungs

and to the pleura; these markers are identifying an expressed pathology. The further radiological examination of lungs resulted a total bilateral shadowing. The clinical diagnosis: acute bilateral croupous bronchopneumonia.

Trachea and bronchi Cut of bronchus Right lung

Left lung Lungs and pleura Lung tissue

**Detectability of pneumonias of various localization as result of bioresonant testing
(n = 43) in comparison with the standard techniques, in % of the total amount**

Diseases	Bioresonant testing	Physical methods of examination	Radiological methods of examination
Pneumonia, croupous	92 %	93 %	100 %
Pneumonia, right bottom part	89 %	92 %	93 %
Pneumonia, left bottom part	85 %	90 %	90 %
Pneumonia, right top part	87 %	89 %	94 %
Pneumonia, left top part	90 %	90 %	91 %
Pneumonia , central	92 %	90 %	95 %

Thus, the results of bioresonant testing with the hardware-software complex "Biolaz-Oberon" shows that it can be used to make primary diagnostics of respiratory system diseases with a high accuracy. The hardware-software complex "Biolaz-Oberon" allows to detect various pathologies of bronchi-lung system, in particular, the pathology of nasopharynx, trachea, the large bronchial tubes and of bronchioles, the pathology of lung tissue and pleuras themselves. The value of the given method consists in an optimum short time interval (10 minutes for respiratory system examination); within this time the possible diseases of bronchi-lung system can be detected with a high degree of probability and, hence, the further examination and treatment of the patient can be carried out.

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