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Modern Diagnosis and Treatment of Pneumonia in Children

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Abstract: The article presents material for 2022-2023 on the study of the course of pneumonia in children. A brief overview of current data on the etiology, pathogenesis, diagnosis, and antibacterial therapy of pneumonia in children is presented. Especially in outpatient settings, serious problems of pediatrics are early diagnosis and rational therapy of pneumonia in children. It should be clarified that the etiology of diseases of the lower respiratory tract differs sharply in different age groups. The most common cause of community-acquired pneumonia (up to 50%) is S. pneumoniae, less common are such sticks as E.coli, Klebsiella spp., C.trachomatis, Mycoplasma, Ureaplasma. In children older than 5 years in the etiological structure of community-acquired pneumonia, along with S. rpeimopiae, the importance of Mycoplasma rpeimopiae increases. The algorithm for diagnosing community-acquired pneumonia includes febrile fever lasting > 3 days, cyanosis, shortness of breath in the absence of signs of bronchial obstruction, cough. Tachypnea is one of the best predictors of pneumonia in children of all ages. During physical examination — the presence of a shortening of the percussion sound in the affected area, bronchial or weakened breathing, sonorous small-bubbly or crepitating wheezes.

Keywords: pneumonia, modern diagnostics, antibacterial therapy, bronchial obstruction Современние

Relevance. Epidemiological studies on the etiology of community-acquired pneumonia in pregnant women indicate the similarity of microorganisms with those that cause diseases in non-pregnant adult women. However, it should be mentioned here that most of these studies were observational and, as a rule, retrospective, during which only routine methods of microbiological diagnostics (sputum culture studies, hemoculture) were used. Currently, community-acquired pneumonia (VP) is of particular relevance to a general practitioner due to its high prevalence in the pediatric population[4,7]. In practice, especially in outpatient settings, early diagnosis and rational therapy of pneumonia in children are serious problems. According to the World Health Organization (WHO), pneumonia is the main cause of infant mortality worldwide. In particular, among the causes of mortality in children under 5 years of age, it accounts for 17.5%, which annually accounts for about 1.1 million deaths in the world [1, 3, 5]. For the diagnosis of mild community-acquired pneumonia, it is quite enough to limit yourself to clinical symptoms, lung radiography, and a general blood test. Initial antibiotic therapy of community-acquired pneumonia is carried out empirically. In the treatment of mild community-acquired pneumonia in children from 2 months. up to 5 years, the drug of choice is amoxicillin orally. Macrolides are the drugs of choice for children from 5 to 16 years old. In severe pneumonia, the drugs of choice are amoxicillin / clavulanate, cephalosporins of the II, III, IV generation. In general, the duration of antibiotic therapy for community-acquired pneumonia caused by typical bacteria is 7-10 days, with atypical bacteria — 10-14 days. In real clinical practice, when conducting antibacterial therapy, errors are often observed related to the choice of the drug, the route of administration, dosage, mode of use, duration of the course[3,17]. The most common pathogens in VP are

Streptococcus pneumoniae, Summary. In practice, especially in outpatient settings, serious problems of pediatrics are early diagnosis and rational therapy of pneumonia in children. The most common pathogens in community-acquired pneumonia are Streptococcus pneumoniae, Haemophilus influenzae and other microorganisms, including viruses and fungi. It should be clarified that the etiology of diseases of the lower respiratory tract differs sharply in different age groups. The most common cause of community-acquired pneumonia (up to 50%) is S.pneumoniae, less common are such sticks as E.coli, Klebsiella spp., C.trachomatis, Mycoplasma, Ureaplasma. In children older than 5 years in the etiological structure of community-acquired pneumonia, along with S.rpeimopiae, the importance of Mycoplasma rpeimopiae increases. The resistance of infectious agents to antibacterial drugs is a growing global problem. The algorithm for diagnosing community-acquired pneumonia includes febrile fever lasting > 3 days, cyanosis, shortness of breath in the absence of signs of bronchial obstruction, cough. Tachypnea is one of the best predictors of pneumonia in children of all ages[6,17]. During physical examination — the presence of a shortening of the percussion sound in the affected area, bronchial or weakened breathing, sonorous small-bubbly or crepitating wheezes. For the diagnosis of mild community-acquired pneumonia, it is quite enough to limit yourself to clinical symptoms, lung radiography, and a general blood test. Initial antibiotic therapy of community-acquired pneumonia is carried out empirically. In the treatment of mild community-acquired pneumonia in children from 2 months to 5 years, the drug of choice is amoxicillin orally. Macrolides are the drugs of choice for children from 5 to 16 years old. In severe pneumonia, the drugs of choice are amoxicillin / clavulanate, cephalosporins of the II, III, IV generation. In general, the duration of antibiotic therapy for community-acquired pneumonia caused by typical bacteria is 7-10 days, with atypical bacteria — 10-14 days. In real clinical practice, when conducting antibacterial therapy, errors are often observed related to the choice of the drug, the route of administration, dosage, mode of use, duration of the course. Keywords: community-acquired pneumonia, diagnosis, antibacterial therapy. Haemophilus influenzae and other microorganisms, including viruses and fungi. It should be clarified that the etiology of diseases of the lower respiratory tract differs sharply in different age groups. The most common cause of VP (up to 50%) is S.pneumoniae, less common are such sticks as E.coli, Klebsiella spp., C.trachomatis, Mycoplasma, Ureaplasma [3, 4]. In children from 1 month of life to 3 years of age, the role of respiratory viruses increases in the etiology of community-acquired pneumonia, which can be both an independent cause of the disease and create viral-bacterial associations [5, 11, 20]. Respiratory viruses as independent etiological factors in the development of diseases of the lower respiratory tract are most often observed in children under the age of 1 year. By the age of 5, their etiological role is noticeably reduced. Infections of the lower respiratory tract and pneumonia in young children are more often caused by rhinosyncytial virus, parainfluenza virus of the 1st and 3rd types. Mixed viral and bacterial infection accounts for 30-50 % in the etiology of VP in children [5, 6, 10, 17]. The widespread use of vaccination against pneumococcal infection has reduced the infectious morbidity [15]. The frequency of pneumococcus excretion as an etiological factor of pneumonia increases to values characteristic of older age only after 6 months of life, and for Hemophilus bacillus this level is reached only by the end of the second year (35-45% — for S.pneumoniae and 10% — for H.influenzae) [10]. However, the relevance of pathogens such as S.aigeis, especially methicillin-resistant S.aureus, S.pyogenes, K.pneumoniae and E.coli, which cause severe, including destructive pneumonia and mortality, remains high [4]. In children over 5 years of age, the etiological structure of VP along with S.pneumoniae increases the importance of Mycoplasma rheimopiae. M.pneumoniae has a three-layer cytoplasmic membrane instead of a cell wall, which causes their resistance to various agents that inhibit the synthesis of the cell wall, primarily to penicillin and other lactams. Chlamydia is the next most common atypical pathogen of VP in children [11, 19]. So, the main pathogens of VP are pneumococcus, somewhat less often — hemophilic bacillus, in children from 5 years of age the role of mycoplasma and chlamydia increases. The resistance of infectious agents to antibacterial drugs (ABP) is a growing global problem. A high level of resistance and polyresistance (loss of sensitivity to several ABPS at once) is observed mainly in

patients with chronic diseases, often receiving antibiotics, and in children in closed collectives (boarding schools, orphanages) [5, 6]. The algorithm of diagnosis in VP consists of generally accepted clinical symptoms using modern laboratory methods.-instrumental diagnostics [6]. WHO experts believe [25, 26] that in typical cases, pneumonia is characterized by: febrile temperature lasting > 3 days; cyanosis and shortness of breath > 60 in 1 min in children under 2 months, > 50 — at the age of 2-12 months, > 40 — in children from 1 to 5 years and > 30 — in children over 5 years in the absence of signs of bronchial obstruction; cough. Tachypnea is one of the best predictors of pneumonia in children of all ages. It is advisable to count the number of respiratory movements of the child with calm breathing for 1 minute. Physical examination of the patient reveals a shortening of the percussion sound in the affected area, bronchial or weakened breathing, sonorous small-bubbly or crepitating wheezes [10,13]. Chest radiography remains the gold standard for the diagnosis of pneumonia, which makes it possible to assess the size of infiltrative changes in the lungs and their prevalence, the presence or absence of pleural effusion or destruction of lung tissue.

Materials and methods. Previously, in the manuals of previous years on pneumonia, focal, lobular, segmental infiltrative changes in lung tissue were associated with bacterial infection, and interstitial with viral infection. Observations of recent years have shown the futility of using the X-ray method for the approximate etiological diagnosis of the disease, correction of treatment. With uncomplicated VP, with a good positive dynamics of the course of the disease, there is no need for a control radiography immediately after the end of the course of antibacterial therapy (ABT). It is advisable to conduct a control X-ray examination no earlier than 4-5 weeks from the onset of the disease. In complicated pneumonia , dynamic monitoring is carried out in the presence of progression of symptoms of lung damage and before the patient is discharged from the hospital . In the diagnosis of VP of bacterial etiology, counting the number of leukocytes and their formulas is of limited use. Leukocytosis > 10-12 • 109 /l and leucoformule shift to the left (> 10% of rod-shaped neutrophils) indicate a high probability of bacterial infection. Studies have found that 93% of children with VP and the number of leukocytes more than 20,000 (> 20 • 109 / l after antibiotic therapy) had an improvement in indicators compared to 50% of patients with VP and the number of leukocytes less than 10,000 (10 • 109 / l).

Results and discussion. For the diagnosis of non-severe VP, it is quite enough to limit yourself to clinical symptoms, lung radiography, and a general blood test. The diagnosis of pneumonia is reliable in the presence of an infiltrative shadow on the lung radiograph in combination with at least two of the following clinical and laboratory signs: febrile fever, cough, auscultative signs of pneumonia, leukocytosis > 10-12 • 109 /l and/or a rod-shaped shift of the leukoformula > 10%.Diagnostic methods for severe pneumonia: determination of liver enzyme activity, creatinine and urea levels, C-reactive protein index, procalcitonin concentration (PCT), which correlates with the severity of bacteremia and is used as a prognosis of the course of the disease, acid-base state and blood electrolytes, electrocardiography, verification of a causally significant pathogen by blood culture, microbiological examination of sputum or secretions from the upper respiratory tract. To clarify the etiology of the disease of atypical pathogens, molecular (polymerase chain reaction) and serological research methods are used. Non-severe VP is treated on an outpatient basis. Indications for hospitalization of children are: the age of the child is less than 2 months, regardless of the severity and prevalence of the process, children under 3 years of age with a partial lesion of the lungs, the age of a child under 5 years of age with a lesion of more than one lobe of the lung, children with a burdened premorbid background: severe encephalopathy of any genesis, congenital malformations, chronic bronchopulmonary diseases and cardiovascular systems, kidney diseases, diabetes mellitus, neoplasms, immunodeficiency conditions, children from socially disadvantaged families, with poor social and living conditions, children with complicated forms of pneumonia, in the absence of positive dynamics within 48-72 hours after empirical antibacterial therapy in outpatient settings. Initial antibiotic therapy of VP is carried out empirically, since the etiological pathogen is rarely known at diagnosis. The choice of ABT in each case of VP is carried out individually, taking into account the natural activity of

drugs against the pathogen and their possible acquired resistance, the severity and course of the disease, the presence of contraindications to the use of certain antibiotics in the patient. Principles of empirical therapy: early administration of ABP, taking into account the most likely pathogen and its sensitivity in the region, the age of the patient, the presence of background diseases, toxicity and tolerability of ABP for a particular patient. In the treatment of mild VP in children from 2 months to 5 years, the drug of choice is amoxicillin orally, if the child has received antibacterial therapy — amoxicillin + clavulanate for the last 3 months. Evidence-based studies have shown that the use of amoxicillin orally, even with severe uncomplicated VP in children, is not inferior in effectiveness to benzylpenicillin or ampicillin administered intravenously. In this regard, in all children with VP who do not have indications for hospitalization, as well as in hospitalized children with moderate VP, it is advisable to use oral ABT. In severe community—acquired pneumonia, ABP is prescribed parenterally or as a step therapy - two-stage use of antibiotics: the transition from parenteral administration to oral administration after the patient's condition improves (usually 2-3 days after the start of treatment). This leads to a reduction in the cost of treatment and a reduction in the length of hospital stay while maintaining high efficiency. The drugs of the alternative group are cephalosporins of the second generation (cefuroxime axetil) or macrolides. Macrolides and cephalosporins can be used in patients with penicillin allergy. Currently, macrolides are the drugs of choice in children from 5 to 16 years old, as they remain highly active against S.pneumoniae, M.pneumoniae and C.rheimopia. The drugs of choice for patients with severe pneumonia requiring hospitalization are amoxicillin + clavulanate (intravenously — IV) or cephalosporins of the second generation. Alternative antibiotics are cephalosporins of the III or IV generation. Ceftriaxone and cefotaxime (third generation cephalosporins) retain high sensitivity to pneumococcus and Hemophilus bacillus — resistant forms do not exceed 2 %. Recommended doses and administration modes are presented. The duration of antibacterial therapy depends on the severity and course of the disease, as well as the presence of background diseases. The criterion for stopping the course of antibacterial therapy in the treatment of mild VP is clinical recovery, even with the preservation of residual changes on the X-ray. In general, the duration of antibiotic therapy for VP caused by typical bacteria is 7-10 days, with atypical bacteria — 10-14 days In dynamics After 24-48 hours, the effectiveness of empirically prescribed therapy should be evaluated. It is not necessary to cancel the antibiotic in the early stages (on the 3rd-4th day), since the eradication of pathogens is not achieved, the development of antibiotic-resistant strains is potentiated. However, recent studies have shown the possibility of reducing the duration of ABT in children with VP by 1.5–2 times (from 9-11 to 5-6 days) under the control of blood procalcitonin levels. This makes it possible to reduce the consumption of ABP without reducing the effectiveness, the time of hospitalization, reduce the number of adverse drug events, and also helps to curb the growth of bacterial resistance. Determination of the blood PCT level can be carried out in all hospitalized children with VP Modern recommendations for the treatment of VP offer a number of measures to prevent the disease. These include frequent hand washing, exclusion of tobacco smoke, breastfeeding, reduction of contact with other children, immunization with a pneumococcal conjugate vaccine approved for the prevention of invasive pneumococcal diseases, as well as immunization against other potential causes of pneumonia, including influenza, H.influenzae type B, whooping cough, chickenpox and measles in children.

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