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ETIOLOGY OF COMMUNITY-ACQUIRED PNEUMONIA IN CHILDREN OF BARNaul

The results of a survey of 1,118 Barnaul children aged 0 to 17 years to determine the etiological structure of community-acquired pneumonia pathogens from January to October 2024 are presented. *Mycoplasma pneumoniae* was the predominant pathogen - 36%, less often COVID-19. The clinical picture of mycoplasma pneumonia in children is atypical. Etiotropic therapy brings good results.

Keywords: children, community-acquired pneumonia, mycoplasma

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Introduction. In Russian pediatrics, as in most countries of the world, pneumonia is defined as "an acute infectious disease of the pulmonary parenchyma, diagnosed by the respiratory distress syndrome and/or physical data, as well as infiltrative changes on the radiograph" [3,7,8].

The most important principle from a clinical point of view provides for the division of pneumonia into community-acquired (CA) and nosocomial [11].

The etiological structure of pneumonia in children is very diverse and depends on the age of the child. Data on the etiology of CA in children vary greatly, which can be explained by the different epidemiological conditions in which the studies were conducted, as well as their methodologies. The study of this problem is relevant both for the choice of etiotropic therapy tactics, and for the prognosis of the disease and measures of specific and non-specific prevention [1,5,6].

Materials and methods. In a cross-sectional retrospective study, weekly reporting forms for monitoring

community-acquired pneumonia for the Ministry of Health of the Altai Region were analyzed. The period of results evaluation was from January to November 2024. The study included three large medical and preventive healthcare institutions in the city of Barnaul, providing primary care to children. The pathogen was identified by the polymerase chain reaction (PCR) method after collecting biological material (a swab from the throat and nose) from a child during the initial visit to the clinic. An analysis of 30 medical records of patients who were treated in the somatic-pediatric department of the Altai State Budgetary Institution of Health "Children's City Hospital No. 1, Barnaul" was also conducted. All children were diagnosed with community-acquired pneumonia caused by *Mycoplasma pneumoniae* (J15.7). The complete blood count was determined using the Mindray BC 5150 automatic hematology analyzer. Biochemical studies were performed using the Mindray BS 380 automatic chemistry analyzer. C-reactive protein (CRP) was determined photometrically. The following pathogens were determined: mycoplasma, rhinovirus, RS virus, parainfluenza virus types 1,2,3,4, adenovirus, Epstein-Barr virus, influenza A, COVID 19 using the polymerase chain reaction (PCR) method on the BioExpert PCR amplifier. The control group included children of health groups 1 and 2.

Statistical processing of the results was performed using the statistical software package "STATISTICA 10.0 (StatSoftInc). The Shapiro-Wilk test was used to test the hypothesis of the normal distribution of empirical data. It evaluates the sample data with the null hypothesis that the data set is normally distributed. The Mann-Whitney U test was used to determine whether there was a significant difference between two independent,

non-normally distributed groups of data. Fisher's exact test and Pearson's χ^2 test determined whether there was a statistically significant difference between the qualitative indicators in the study groups.

Results and discussions. 1,118 children aged 1 to 17 years were examined. Girls are 581 (52%), boys are 537 (48%).

Table 1 shows the distribution of children by age, with school-age children predominating ($p < 0.01$). The control group for comparison of laboratory parameters consisted of 92 children who were comparable by gender and age: 37 girls (40.2%), 55 boys (59.8%).

As can be seen from Table 2, the largest number of analyses were performed in the largest (in terms of the number of registered children) City Children's Clinic No. 14 – 765, significantly fewer in Children's Clinic No. 9 – 213, and 140 in Children's Clinic No. 3.

The main pathogen in children was *Mycoplasma pneumoniae* (32.3-33.3%) ($\chi^2 = 203.7$, $p < 0.01$), less frequently isolated were Rhinovirus and Human orthopneumovirus. Parainfluenza viruses and COVID-19 were detected in 1.5%. Undifferentiated pathogens were registered in 58.2-62% of patients ($\chi^2 = 129.3$, $p < 0.01$). The peak incidence was observed from mid-September to October.

Depending on age it was found that children aged 0 to 2 years are the least likely to get sick ($p < 0.05$), the pathogen type was mostly undetermined, mycoplasma was isolated less frequently (32.3%). From 3 to 6 years, parainfluenza, pneumometavirus and unknown pathogens are predominantly determined. Most children in the age group of 7-14 years have mycoplasma as the causative agent of pneumonia ($p < 0.05$). 15-17 years old children have mainly mycoplasma (32.3%) and less frequently influenza A (1.5%).

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Table 1

Распределение обследованных детей по возрасту, абс. (%)

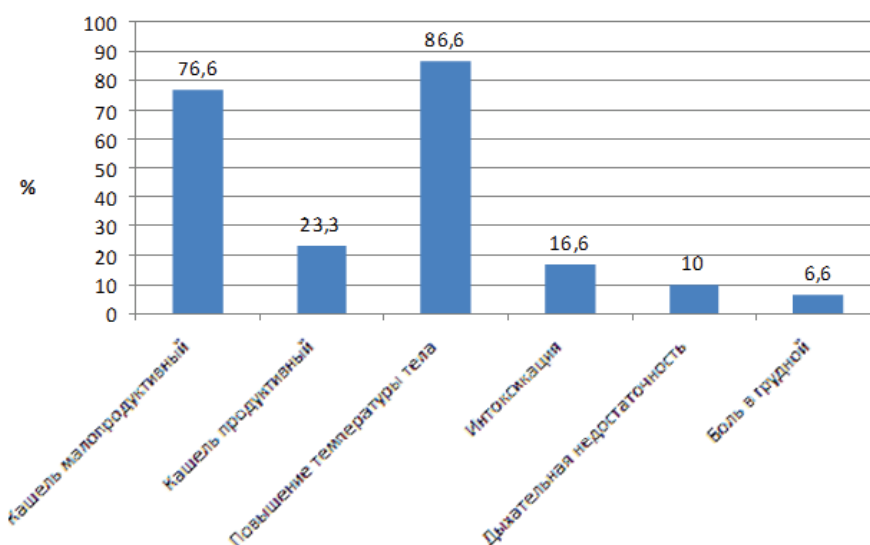
Возраст детей (лет)	0-2 года	3-6 лет	7-14 лет	15-17 лет
Поликлиника № 3	6 (0,54)	26 (3,22)	73 (6,53)	17 (1,52)
Поликлиника № 9	12 (1,07)	45 (4,92)	73 (10,73%)	24 (2,15)
Поликлиника № 14	45 (4,03)	126 (11,4)	423 (37,84)	159 (14,22)
Всего	63	218	569	200

Table 2

Возбудители внебольничной пневмонии у детей по данным детских поликлиник г. Барнаула, абс. (%)

Поликлиника	Возбудитель							Всего
	Микоплазма	Риновирус	РС-вирус	Вирусы парагриппа 1,2,3,4 типа	Другие респираторные вирусы (аденовирус, ВЭБ, грипп А и др.)	Недифференцированные внебольничные пневмонии	COVID 19	
3	83(20,6/59,3)	2(18,2/1,4)	-	3(60/2,1)	3(14,3/2,1)	43(6,7/30,7)	6(28,6/4,3)	140
9	71(17,7/33,3)	-	6(35,3/2,8)	1(20/0,5)	7(33,3/3,3)	124(19,3/58,2)	4(19/1,9)	213
14	248(61,7/32,3) *	9(81,8/1,1)	11(64,7/1,5)	1(20/0,1)	11(52,4/1,5)	474(73,9/62) *	11(52,4/1,5)	765
Всего	402	11	17	5	21	641	21	1118

Примечание. ВЭБ – вирус Эпштейна-Барр, * - статистическая значимость рассчитана по χ^2 критерию Пирсона.



Жалобы пациентов с микоплазменной пневмонией (%)

After examination at the pediatric department, the pediatrician diagnosed all children with ARVI (J06.9) and prescribed symptomatic treatment and antiviral drugs. After 3-5 days the condition was without positive dynamics, the high temperature persisted, the children took antipyretic drugs, and a hacking cough appeared. They returned to the pediatrician. An X-ray examination of the chest organs, an overview X-ray and PCR diagnostics were performed.

Infiltrative changes in the lungs were detected and mycoplasma was isolated; the child was sent for hospitalization to the Altai State Budgetary Institution of Health «Children's City Hospital No. 1, Barnaul» with a diagnosis of «Pneumonia».

The analyze of hospital case histories showed that disease began acutely with a rise in temperature to 39.0 ° C -39.6 ° C. A dry cough appeared after 2 days. There were signs of intoxication (headache, weakness, malaise), but not in all patients, only three children from 30 had ones - 10%.

When analyzing the complaints of children in the study group who were hospitalized (Picture 1), it was found that the main ones were: fever (86.7%), unproductive cough (76.7%), productive cough (23.3%), intoxication (16.7%), respiratory failure (10.0%), chest pain (6.7%).

2/3 of patients had complaints about the course of acute respiratory viral infection (ARVI).

During auscultation of 30 children wheezing was not heard in 19 (63.3%) children throughout the disease. 7 (23.3%) had wet fine-bubble wheezing, which stopped on the 4-5th day, but harsh breathing remained, another 5-6 days in 4 (13.3%) children wheezing appeared on the 4-5th day of treatment.

In the clinical blood test, moderate leukocytosis up to 10-12 thousand in 1 μ l was detected only in 17 (32.7%) patients, a shift in the leukocyte formula to the left - in 9 (17.3%) children. Of the hematological changes characteristic of mycoplasma infection, eosinophilia was detected in 13 (25%) people, increased ESR (20-40 mm / h) - in 25 (48.1%). The average ESR values \backslash u200b \backslash u200b children with pneumonia was 7.9 mm / h. Leukocytosis out of 30 patients was observed in 8 (26.6%) children, its average value was $12.1 \times 10^9 / l$. Thrombocytosis was observed in 3 (10%) children. Lymphocytopenia was observed in 17 (56.6%) children. Monocytosis was found in 14 people (46.6%), monocytopenia was observed in 4 children (13.3%). Average hemoglobin value in 7 people was 109

g/l, first-degree anemia [5]. In children of the study group, hemoglobin and leukocyte levels were statistically significantly higher than in children of the comparison group ($p < 0.05$). Hypochromic anemia was detected in 7 (23.3%) children of the study group. This may be due to the fact that the causative agent is mycoplasma, which can cause hemolysis and hemagglutination of erythrocytes, which leads to the development of transient hemolytic anemia [2]. An increase in platelets in some children is due to high temperature, which leads to impaired microcirculation and the development of microthrombosis (development of DIC syndrome) [4].

In the absence of changes in the general blood test characteristic of the usual "bacterial" nature, they may prompt the doctor to consider the microplasma nature of pneumonia [10].

Biochemical blood test. Total protein average value 72.64 g/l. - normal, C-reactive protein (CRP) average value is 56.3 mg/l - elevated. Currently, CRP is considered the most sensitive "reference" laboratory marker of systemic inflammation, tissue damage and infectious alteration. An increase in its concentration in the blood of more than 50 mg/l in the presence of respiratory symptoms with a high probability confirms the presence of community-acquired pneumonia.

General sputum analysis. Segmented neutrophils are continuous. They may indicate an acute, severe inflammatory process. Detection of more than 25 neutrophils in the field of view indicates an infection (pneumonia, bronchitis). Flat epithelium has 3-4 (4-5) cells. The presence of more than 25 flat epithelial cells in the sputum indicates the presence of saliva in the sputum. Abundant coccal flora was observed with bacterial pathogens and infectious processes in the respiratory tract. Sputum cultures are ineffective in mycoplasma pneumonia.

Results of chest X-ray in direct projection are showed the following: lobar pneumonia is in 22 children (73.3%). Upper lobe pneumonia is in 5 children (22.7%), middle lobe pneumonia is in 6 children (27.3%), lower lobe pneumonia is in 11 children (50%), polysegmental pneumonia is in 3 children (10%). As a rule this is a bilateral pneumonia. Most often it is in segments S4, S5 and S9. Segmental pneumonia is in 5 children (16.6%). In 3 children the S3 segment is involved in the process (60%). And one S4 and S6 (20%), as a rule, are manifested in segment atelectasis.

In the hospital, Azithromycin tablets and symptomatic treatment were

prescribed. A positive result was noted against the background of this treatment. The temperature was stopped on the 2-3 day and did not rise anymore. The child's health improved significantly. Signs of intoxication disappeared along with the temperature. The children felt much better. Children are discharged on the 7-10 day and transferred to outpatient treatment, if necessary.

When prescribing therapy, the characteristics of *Mycoplasma pneumoniae* should be taken into account. It is characterized by natural resistance to antibiotics that act on the synthesis of the cell wall - β -lactams, glycopeptides, fosfomycin [9]. It is a very small, free-living, gram-negative, facultative anaerobic bacterium lacking a true cell wall. [10]. Macrolides are the first line of treatment for mycoplasma pneumonia. Azithromycin has better in vitro activity, while lincosamides, especially lincomycin, exhibit moderate activity. In addition, it has an immunomodulatory and anti-inflammatory effect. It is considered less toxic and bladeless, which is important when choosing therapy for a child's body [10]. However, it differs from other macrolides in its significantly greater effectiveness against these bacteria. It exceeds other drugs in the group in terms of effectiveness. Its high effectiveness against intracellular mycoplasma pathogens has been proven [10].

When starting antibiotic treatment, the temperature drops on the second day to 37.5°C - 37.0°C. On the 3rd day it went to 37.0°C - 36.7°C and did not rise again throughout the entire course of the disease.

Conclusion. Thus, community-acquired pneumonia remains a relevant and problematic topic. Clinically, pneumonia caused by *Mycoplasma pneumoniae* is very difficult to diagnose when a patient first comes to the clinic. Because the first signs are hidden under «masks». In this regard, most doctors miss the onset of the disease, which further complicates treatment.

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