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Risk Factors for Protracted Community-Acquired Pneumonia in Children

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Abstract **Relevance of the research problem:** Pneumonia is an acute infectious disease, predominantly of bacterial etiology, characterized by a focal lesion of the respiratory departments of the lungs, the presence of intra-alveolar exudation detected by physical and instrumental examination, and a febrile reaction and intoxication expressed in varying degrees. **Objective:** Identify factors that have prognostic value in the formation of a protracted course of community-acquired pneumonia in children. **Materials and methods:** The results of a retrospective analysis of 6790 histories of treated patients with bronchopulmonary pathology at the clinic in Samarkand for the period 2015-2017, as well as the results of a prospective study of 100 patients with CAP aged from 6 months to 15 years who were admitted to inpatient treatment at the Department of Pulmonology of the Republican Specialized Scientific and Practical Medical Center of Pediatrics and Samarkand State Medical Institute. **Results of the study:** In a retrospective analysis of 6790 case histories of children with bronchopulmonary diseases treated in Samarkand, 63.3% of children had community-acquired pneumonia. It should be noted that radiological confirmation of pneumonia was noted only in case histories of 64.6% of patients. It shows that 35.4% had overdiagnosis of community-acquired pneumonia. **Conclusions:** Based on a retrospective analysis, it was revealed that general practitioners have overdiagnosis of community-acquired pneumonia and incorrect management of antibiotic therapy, and this in turn leads to a prolonged course of the process in the lungs.

Keywords Pneumonia, C-reactive protein, Procalcitonin, Overdiagnosis, Diseases of the bronchi and lungs

1. Relevance of the Research Problem

Pneumonia is an acute infectious disease, predominantly of bacterial etiology, characterized by a focal lesion of the respiratory departments of the lungs, the presence of intra-alveolar exudation detected by physical and instrumental examination, and a febrile reaction and intoxication expressed in varying degrees [2, 6]. Due to the success of recent years, achieved in the diagnosis and treatment of community-acquired pneumonia (CAP) in children, the course of the disease has changed, the number of severe forms of the disease has decreased, and the mortality rate has decreased [1, 8]. However, the urgency of the problem of pneumonia remains, the prevalence of the disease is still quite high, and despite the fact that the CAP is usually attributed to controlled diseases, mortality is recorded annually. In recent years, cases of prolonged pneumonia have increased, which is caused by atypical pathogens and the ineffectiveness of antibacterial therapy [2, 4, 7].

With prolonged remission of pneumonia, the pneumonic infiltrate is absorbed slowly, over an extended period of time (from above 4-6 weeks). About 30% of acute pneumonia take a protracted nature of the flow. The reasons for this may be chronic intoxication or a weakened state of the body, irrational antibiotic therapy, a concomitant violation of the drainage function of the bronchi, prematurity and a complicated course of acute pneumonia. However, in the practice of the pediatrician, there are frequent cases of misinterpretation of clinical symptoms in terms of determining the variant of CAP (typical or caused by atypical flora) and the associated erroneous starting antibacterial therapy [3-5].

The inflammatory biomarkers include procalcitonin and C-reactive protein, the study of which in the diagnosis of bronchopulmonary diseases in children is a promising direction. Studying the possibility of using these biomarkers of inflammation to predict the course of the disease will be a promising scientific direction.

2. Objective

Identify factors that have prognostic value in the formation of a protracted course of community-acquired pneumonia in children.

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3. Materials and Methods

The results of a retrospective analysis of 6790 histories of treated patients with bronchopulmonary pathology at the clinic in Samarkand for the period 2015-2017 y, as well as the results of a prospective study of 100 patients with CAP aged from 6 months to 15 years who were admitted to inpatient treatment at the Department of Pulmonology of the Republican Specialized Scientific and Practical Medical Center of Pediatrics and Samarkand State Medical Institute.

C-reactive protein (CRP) in the blood serum was determined in an automatic analyzer immunohemilyuminestsentnom Immulite 2000 (Siemens, Germany). Determination of the concentration of procalcitonin (PCT) in the serum was performed on an Advia Centaur automatic immuno-chemiluminescent analyzer (Siemens, Germany). The data were processed by the method of variation statistics Fisher - Student using personal computers and use of the application package.

4. Results of the Study

In a retrospective analysis of 6790 case histories of children with bronchopulmonary diseases treated in Samarkand, 63.3% of children had community-acquired pneumonia. It should be noted that radiological confirmation of pneumonia was noted only in case histories of 64.6% of patients. It shows that 35.4% had overdiagnosis CAP. The subjective error in the appointment of the starting antibiotic is the wrong choice of the drug in 21.2% of cases. Advantageously administered antibiotics penicillin, and 45% of the starting preparation was ceftriaxone. At 12.0% conducted unreasonably repeated courses of treatment and further a second aminoglycoside antibiotic. Moreover, amikacin was prescribed more often in 40.0% of cases. Schemes with the appointment of a combination of cefazolin and amikacin in 9.5% of children are also defined as inadequate: excessive prescription of 1st generation cephalosporin.

In the analysis of 7397 case histories of children treated in the Samarkand region for the period 2015 - 2017. at 35.9% it was found CAP. As a result of the analysis, overdiagnosis of CAP was found in 13.8% of children. Irrational use of antibacterial drugs in children treated in hospitals reaches 15.5% of cases. In all cases, there was an empirical choice of starting antibiotic therapy: therapy began without taking into account the sensitivity of pathogens to antibiotics. Inadequate use of cephalosporins 1st generation in the appointment, which is not necessary, have a narrow spectrum of activity and a low level of activity against bacteria and further the problem of growth of antibiotic resistance.

In the analysis of 6426 case histories of children treated in the Samarkand region for the period 2015-2017. 45.5% had CAP. As a result of the analysis, overdiagnosis of CAP was revealed in 15% of children. The subjective error in the appointment of the starting antibiotic is the wrong choice of the drug in 15.3% of cases. The main causes of overdiagnosis of CAP are underestimation of the history and incorrect interpretation of radiological and laboratory data, as well as unreasonable use of antibiotics, leading to a prolonged course of the process in the lungs.

The content of CRP increases in serum during inflammation (infectious diseases). Normal concentration of CRP in serum does not exceed 8 mg / l. In a prospective study, out of 35 examined CAP patients in the initial period of the disease, 28.6% (10) had an increased CRP level in blood serum, and 71.4% (25) children had it within the normal range (fig. 1).

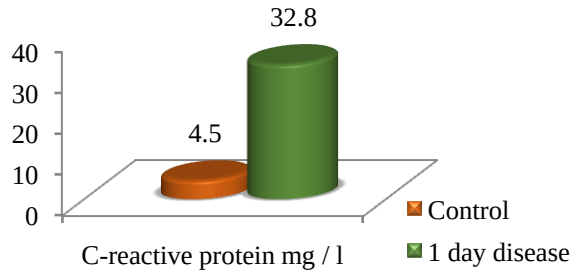

Figure 1. Indicators of C-reactive protein in children with CAP, M±m

Studies have shown that the level of CRP in the serum of children with CAP in the initial period of the disease was significantly higher (7 times), compared to the control group, being 31.9 ± 7.6 mg / l. We have identified more significant changes in the content of CRP in the blood during CAP in older children, whereas in young children in the acute period of the disease they were less pronounced ($P < 0.05$).

According to literary data, this is explained by the physiological immaturity of the protein-synthetic function of the liver in young children and the functional insufficiency of monocytes, which are producers of inducers of the synthesis of proteins of the acute phase.

Recently, much attention as a biomarker of inflammation has been given to procalcitonin (PCT), the precursor of the hormone calcitonin, which is a glycoprotein consisting of 116 amino acids. The concentration of PCT increases following the level of proinflammatory cytokines (such as tumor necrosis factor alpha, interleukin-6). In viral infections, the concentration of PCT does not change, or is slightly increased in the case of a severe course. To study the level of PCT as a supporting factor in the formulation of indications for antibiotic therapy were examined 32 patients with CAP.

Analysis of the results of children with CAP in the initial period of the disease revealed an increase in the level of PCT in serum in 46.9% (15) patients, and amounted to 0.3 ± 0.01 ng / ml, which was 7.5 times higher. This, in turn, is an indication for prescribing antibiotic therapy. In 53.1% (17) children, this indicator was within the normal range (fig. 2).

A PCT level that exceeds the control range is likely to indicate the presence of a systemic bacterial infection and is an indication for early antibiotic therapy. Low values of PCT

indicate an unlikely systemic bacterial infection.

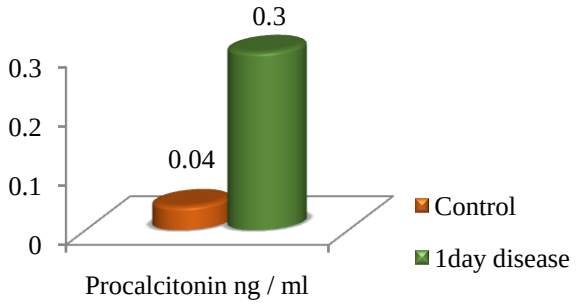

Figure 2. Indicators of procalcitonin in children with CAP, M ± m

Therefore, the serum PCT level has the diagnostic value of an invasive bacterial infection marker. It should be noted that with data less than 0.5 ng / ml, X-ray examination revealed unilateral damage to the lung tissue, and the course of pneumonia was characterized as uncomplicated.

Thus, the obtained data allow us to conclude that a comprehensive assessment of the concentration of inflammatory biomarkers in combination with other clinical and laboratory parameters may be useful in monitoring the pulmonary inflammatory process and will allow to avoid the unreasonable prescription of antibacterial drugs.

5. Conclusions

1. Based on a retrospective analysis, it was revealed that general practitioners have overdiagnosis of community-acquired pneumonia and incorrect management of antibiotic therapy, and this in turn leads to a prolonged course of the process in the lungs.
2. Evaluation of biomarkers of inflammation C-reactive protein and procalcitonin is an informative indicator in the diagnosis of community-acquired pneumonia in children, their increase is confirmed by the bacterial nature of the pathological process, which can be used when choosing differentiated therapy.

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