

THE INTENSITY OF POST-VACCINATION IMMUNITY TO PERTUSSIS INFECTION IN CHILDREN WITH HEALTH ABNORMALITIES

¹Daminova M.N., ²Abzalova Sh.R.

^{1,2}Tashkent Pediatric Medical Institute

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Abstract. Whooping cough is an acute infectious bacterial disease, the main symptom of which is a paroxysmal cough, characterized by a rather severe clinical course, as well as often the development of serious complications from the respiratory and nervous systems in children of different ages. The article presents the results of an analysis of the incidence of whooping cough and the quality of vaccine prevention according to seromonitoring data of 111 children, of which 76 children with health problems aged from 3 to 10 years, 34 boys (44.74%) and 42 girls (55.26%) vaccinated against whooping cough, on an individual schedule, in a family clinic. The control group consisted of 35 relatively healthy children. The work assessed the immunological activity in children with health problems vaccinated against whooping cough. Determination of class G (IgG) antibody titers using enzyme-linked immunosorbent assay (ELISA). Sera with IgG antibody levels above 11 units were considered seropositive. The results of the study showed that in the 76 children we examined with health problems, 2/3 were patients with frequent acute respiratory viral infections 48(63.16±1.21%) ($P<0.05$). When vaccinating against whooping cough in children with health problems and a high incidence of previous diseases, the level of anti-whooping cough antibodies was 27.63% of children. Recommendations are presented that an inadequate immune response to vaccination against whooping cough in children with health problems allows us to consider such children as a group at increased risk for ineffective vaccination and justifies the need to use individual tactics when immunizing them.

Keywords: whooping cough; children; vaccination; immune response; health problems.

Relevance. Today there is a large percentage of children with health problems. Despite this, in order to develop an adequate immune response in such children to various infections, an individual and differentiated approach is required [2,8,15,16]. Based on this, a number of criteria should be identified that are comprehensively capable of solving the issues of managing children with health problems. these include: severity of the main diagnosis; the number and severity of somatic diseases and developmental defects accompanying the main diagnosis; functional state of the nervous and immune systems, etc. [10,11].

Whooping cough is an acute infectious disease of bacterial nature, manifested in the form of attacks of spasmodic cough accompanying catarrhal symptoms and characterized by widespread, rather severe clinical course [5,7], the presence of serious complications from the respiratory and nervous systems in infants, as well as the preservation of the carrier of the pathogen among adults and children [6]. Despite the fact that since 1974, whooping cough has been among the infections vaccinated against on a global scale, and significant progress has been made in reducing mortality and morbidity, infection remains an urgent health problem worldwide to this day. Whooping cough is classified as a disease from which death can be prevented by vaccination. The outcome of infection for each child is determined mainly by the presence or absence of

acquired immunity [3,5]. The sources of whooping cough are patients with clinically pronounced and erased forms, as well as bacterial carriers, in contact with which the disease develops in 90% of the susceptible population [1,4]. Specific prevention of pertussis in our country has been carried out since 1959. The first positive changes in the dynamics of the incidence of pertussis began to be registered 5-10 years after the introduction of mass vaccination, by 1975 the incidence rate reached a minimum level, mortality sharply decreased. However, in the early 1990s, due to the low coverage of the child population with vaccinations with the DPT vaccine, the incidence of whooping cough increased [5,7]. In 2002, it was again possible to reduce the incidence of whooping cough. In order to keep the incidence at a sporadic level (3.0-5.0 per 100 thousand population), it is necessary to maintain vaccination and revaccination coverage of at least 95% of the total population subject to immunization against whooping cough in the prescribed time [2,8]. It should be remembered that in many children whooping cough is hidden and they do not cough at all. Instead, they may turn blue or begin to breathe, in which case the disease occurs in the form of a common cold [1]. Whooping cough infection is usually milder in adolescents and adults than in infants and children, especially those who have received the whooping cough vaccine [3,9]. But teenagers and adults can also get serious cases of whooping cough, and especially those who haven't received the whooping cough vaccine may have long bouts of coughing that keep them awake at night [5,16]. Patients who have had this infection say that it is the worst cough of their life. It can also cause serious disruption to daily life and serious complications in the functioning of internal organs [9,13,14]. Therefore, the problem of timely vaccination remains very relevant [4,10,12]. According to this, today, with the increasing incidence of whooping cough, this study is relevant.

The purpose of the study: Based on the above, the purpose of our study was to determine the level of post-vaccination immunity to pertussis infection in children with health problems.

Materials and methods. Analysis of the incidence of pertussis and the quality of vaccination according to seromonitoring data of 111 children, of which 76 children with health conditions aged 3 to 10 years, 34 boys (44.74%) and 42 girls (55.26%) vaccinated against pertussis, according to an individual schedule, in a family polyclinic. The control group consisted of 35 relatively healthy children. The work assessed the immunological activity in children with health disorders vaccinated against pertussis. Determination of antibody titers of class G (IgG) by enzyme immunoassay (ELISA). In this case, an IgG antibody level above 11 units is established as a seropositive or positive result, which will provide an adequate immune response upon contact with infection. Also, an analysis of life anamnestic data was carried out for all examined children, with an emphasis on previous diseases and their frequency. An assessment was made of the general condition of the patients, their clinical and morphological features, the frequency of seronegative episodes and the indicators that influenced them

The results of the study: During a serological study, high titers of protective antibodies against whooping cough were detected in all healthy children. Among the children we examined with health problems, there was no significant difference between the number of boys and girls. The results of the study showed that 55 children (72.37%) out of 76 had high titers of antibodies to whooping cough. The serological diagnosis revealed in 21 (27.63%) of the examined children the absence of protective titers for whooping cough or titers below protective ones. At the second stage, all children who were seronegative to whooping cough were referred for consultation to determine the cause of seronegativity and select individual vaccination tactics. The results of the

study showed that in children with health abnormalities, the relative chance of an inadequate immune response increased due to a complicated obstetric and gynecological history of the mother 26 (34.21%), previous neurological pathology 19 (25%), allergic conditions 25 (32.89%), intrauterine infection 9 (11.84%). Of the patient's anamnestic factors, the risk is increased by artificial feeding 34 (44.74%), thymomegaly 16 (21.05%), protein energy deficiency of grade I 8 (10.53%), anemia 42 (55.26%), violation of the calendar of preventive vaccinations 16 (21.05%). Indicators with a high risk of developing low levels of protective antibodies in children with special health conditions are shown in the table 1.

Table № 1.

Indicators with a high risk of developing low levels of protective antibodies

Prognostic score for progression (median used)	Low level of antibodies in the presence of the factor (%)	Low level of antibodies with absence of factor (%)	Chi ² (confidence)	Relative risk of progression in the presence of the factor
Gynecological history of the mother	17/26 (65.38%)	4/50 (8.0%)	28.169 (p<0.001)	8.17
Neurological pathology	15/19(78.95%)	6/57 (10.53%)	33.361 (p<0.001)	7.51
Allergic conditions	21/25 (84.0%)	0/51	63.504 (p<0,001)	
Acute intestinal infections	19/45 (42.22%)	2/31 (6.45%)	11.745 (p<0.001)	6.55
Artificial feeding	15/34 (44.12%)	6/42 (14.28%)	8.362 (p<0.05)	3.09
Thymomegaly	13/16 (81.25%)	6/60 (10.0%)	29.138 (p<0.01)	8.12
Anemia (Hb<110g/l)	19/42 (45.24%)	2/34 (5.88%)	14.554 (p<0.001)	7.69
3-4 years old	13/27 (48.15%)	8/49 (16.33%)	8.815 (p<0.05)	2.95
Frequent acute respiratory viral infections	20/48 (41.67%)	1/28 (3.57%)	12.834 (p<0.001)	11.67

According to established data, the highest risk (11.67) with a significant level of Chi-square (12.834) is a history of frequent acute respiratory viral infections. The presence of allergic conditions in children had the highest level of Chi-square (63.504), but since all these patients had low levels of antibodies, it was not possible to calculate the risk indicator. Also significantly significant were the presence of a maternal gynecological history with a risk factor of 8.17 and a Chi-square level of 28.169; the presence of thymomegaly with a risk factor of 8.12 and a Chi-square level of 29.138; the presence of anemia with a hemoglobin level below 110 g/l with a risk

factor of 7.69 and a Chi-square level of 14.554; the presence of previous neurological pathologies with a risk factor of 7.51 and a Chi-square level of 33.361, and so on.

When studying the incidence of whooping cough among vaccinated children, the following data were established. Those vaccinated against whooping cough are more likely to have mild and atypical forms of the disease (11.84%), severe forms are recorded in 2.63%. Hematological changes are poorly expressed and are detected in 19.74% of patients; specific complications are rare and not life-threatening. The highest chance of an inadequate immune response is in children with health abnormalities with frequent acute respiratory infections, protein energy deficiency of II-III degree and functional disorders of the respiratory system. Analysis of the research results showed that children with postvaccinal reactions 41 (53.95%) had a history of previous neurological pathology 34 (44.74%), the relative chance of developing a pathological condition in them is 3.3.

The incidence rate of both frequently and episodically ill children is mainly formed due to respiratory diseases. The results of the study showed that in 76 children examined by us with health abnormalities, 2/3 were patients with frequent acute respiratory viral infections in 48 (63.16±1.21%) patients ($P<0.05$), in second place in frequency of occurrence are acute intestinal infections in 45 (59.21±2.11%) patients, allergic manifestations in 26 (34.21±2.15%) patients, bronchitis in 13 (17.11±0.51%) patients ($P<0.05$). The following diseases also occur: chicken pox in 8(10.53±0.22%) patients, pneumonia in 2 (2.63 ±0.05%) patients; sore throats in 10 (13.16±0.17%) patients and other in 13(17.11±0.25%) patients. A combination of frequent diseases in children with allergic reactions was often noted -27.63%.

Exudative diathesis and other manifestations of skin allergies in the group of children with health disorders were noted more than 7 times more often at an early age. The manifestation of the disease was observed in children of both sexes. In the clinical picture, repeated bronchopulmonary infections (100%), ENT infections (100%), gastroenterocolitis (27.63%), purulent soft tissue infections (36.84%), conjunctivitis (26.32%), sore throats (13.16%) prevailed in the anamnesis.

In addition, during the study, to clarify the effect of age on the antibody titer, children were conditionally divided into 2 categories: 3-4 years and 9-10 years. Determination of the level of anti-pertussis antibodies in children in age groups 3-4 and 9-10 showed that all the examined children had antibodies to whooping cough. The proportion of serums with an antibody level below the protective level in children with abnormal health conditions was 27.63%. In the age group of children 3-4 years old, the proportion of sera with low antibody levels was 35.53%, in the group of children 9-10 years old – 19.74%. This fact indicates that the risk of low levels of protective antibodies in children with abnormal health conditions decreases with the age of the patient

Conclusion. Thus, the study established 100% effectiveness of vaccination in healthy children. But in children with abnormal health conditions, there may be disturbances in the development of immunity against whooping cough and the presence of a low level of protective antibodies. Consequently, when vaccinated against whooping cough in children with health disorders, with a high incidence of diseases, the level of anti-whooping cough antibodies was 27.63% of children. The inadequate immune response to pertussis vaccination in children with health abnormalities allows such children to be considered as a high-risk group for ineffective vaccination and justifies the need to use individual tactics in their immunization. The peculiarities of the modern epidemiology of pertussis infection dictate the need to change vaccination tactics

by introducing repeated revaccinations of children and adults using cell-free vaccines, and to prevent the economic costs associated with the treatment of whooping cough patients. In addition, children with special health conditions should take into account the presence of such risk factors as the mother's gynecological history, the presence of previous neurological pathologies, the presence of allergic conditions, frequent respiratory and acute intestinal infections, etc. In the presence of such risk factors, to reduce the cost of vaccination, it should be adjusted. Only with adequate and effective vaccination of all children will a reduction in the incidence of whooping cough be achieved.

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