WHOOPING COUGH AT THE PRESENT STAGE

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Abstract: *Despite high vaccination coverage, whooping cough remains an important cause of childhood morbidity and mortality worldwide. Many countries are experiencing whooping cough epidemics, with vaccinated people accounting for a significant proportion of those affected.*

The objective is to analyze modern data on the causes of the increase in the incidence and characteristics of the course, diagnosis, treatment and prevention of whooping cough in children and adults.

Material and methods. A review of publications by domestic and foreign authors, clinical guidelines for the diagnosis, treatment and prevention of whooping cough was conducted, and data from randomized clinical and epidemiological studies were studied.

Results and discussion. The article presents current data on the epidemiology of whooping cough, the characteristics of its clinical manifestations, diagnostics and treatment in different age groups.

Conclusions. The increase in whooping cough cases may be associated with changes in the antigen structure of the pathogen, short duration of post-vaccination immunity, decreased vaccination coverage, and the use of more sensitive laboratory diagnostic methods. Among those infected, adolescents and adults predominate, who suffer from whooping cough mainly in atypical forms. Severe

and complicated forms of whooping cough, as well as fatal outcomes, are typical for children in the first months of life. The use of modern methods of diagnosis and therapy of whooping cough in clinical practice can reduce the duration and severity of its clinical manifestations, as well as limit the spread of infection. There is a need to improve the whooping cough vaccination strategy, maintain a high level of vaccination coverage and strictly adhere to anti-epidemic measures in foci of infection.

Key words: *whooping cough, epidemiology, diagnostics, treatment, prevention*

Whooping cough is an acute respiratory disease caused by B. pertussis , the main manifestation of which is paroxysmal cough. Despite the success of vaccination, whooping cough remains a significant cause of childhood morbidity and mortality and a serious public health problem worldwide. According to WHO, about 60 million people worldwide fall ill with whooping cough every year and about 1 million children die, mainly under the age of one year [1].

Currently, in many countries of the world (USA, Australia, the Netherlands, Canada, etc.), despite high vaccination coverage of the child population, there is an epidemic of whooping cough. In Russia in 2014, 4705 cases of whooping cough were registered (the incidence rate was 3.23 per 100 thousand of the population). The maximum incidence rates were registered among children under 1 year old - 54.2 per 100 thousand children. Mortality from whooping cough remains (0.007 per 100 thousand of the population). In the age structure of those infected, schoolchildren aged 7-14 years predominate (37.9%), children under 1 year made up 25%, children aged 3-6 years - 18.2%, children aged 1-2 years - 15.3%. The majority of those infected (65%) were vaccinated! [2]. Official statistics most likely do not reflect the real situation with whooping cough, since in practice no more than 10-12% of cases of the disease are diagnosed. The latest reports indicate an 8-

10-fold increase in whooping cough in 2015 in various regions and areas of Russia (Khabarovsk Krai, Prikamye, Kirov Oblast, etc.). In 2015, 83 children were hospitalized in the Republican Infectious Diseases Clinical Hospital of Kazan (including 65 children in their first year of life), while in 2014 only 10 children were hospitalized. Taking into account the birth of 23 thousand children in Kazan in 2015, the incidence of whooping cough (only taking into account the number of hospitalized) in children of the first year of life was about 200-250 per 100 thousand!

According to scientists, the increase in whooping cough incidence rates may be associated with various reasons: the use of more sensitive research methods (polymerase chain reaction), changes in the antigenic structure of the pathogen, insufficient effectiveness of modern vaccines and short duration of post-vaccination immunity, decreased vaccination coverage, etc. [3, 4, 5].

Although whooping cough is a " childhood infection", the age structure of those infected in recent years has been dominated by adolescents and adults, who in most cases suffer from whooping cough in an atypical form. Adolescents and adults are the main source of outbreaks of the disease and infection in families of unvaccinated infants, in whom whooping cough is very severe and poses a direct threat to life [6, 7, 8]. Transmission of the infection occurs by airborne droplets and is possible only through close contact with a sick person or carrier. Vaccinated people can be carriers of the whooping cough pathogen and participate in the epidemic process, spreading the infection. The contagiousness index ranges from 0.7 to 1.0. An autumn-winter increase in morbidity is typical, with a peak in December-January [9].

Currently, whooping cough in unvaccinated people retains all its typical manifestations. The incubation period is from 3 to 14 days. The onset of the disease is gradual with a dynamic increase in dry cough (catarrhal period, duration 1-2

weeks), while symptoms of intoxication, fever are absent, the well-being of patients is slightly impaired. As a rule, at this stage, patients are diagnosed with "ARI". Then the cough becomes paroxysmal (period of spasmodic cough), which lasts from 1 to 6 weeks . A coughing attack with whooping cough consists of a series of short coughing thrusts on exhalation followed by an intense inhalation, which is accompanied by a whistling sound (reprise). During the attack, the patient's face turns red or becomes cyanotic, the jugular veins swell, the eyes water, the tongue sticks out of the mouth and is bent upward. The attack ends with the discharge of viscous, glassy sputum or vomiting. Vomiting after a coughing attack is very typical for whooping cough. Coughing with whooping cough intensifies at night, after physical or emotional stress. The number of coughing attacks during the day varies from isolated to 40-50 or more. The patient's condition between coughing attacks may not be affected (excluding severe forms of the disease), which can disorient the doctor in assessing his condition. The convalescence phase of whooping cough lasts several weeks and is characterized by a gradual decrease in the frequency and intensity of coughing.

In adolescents and adults, whooping cough often occurs in atypical forms and is manifested by a prolonged cough, for which they usually receive ineffective therapy from therapists, allergists and otolaryngologists. However, in these age groups, whooping cough can also occur typically and be complicated by pneumonia (2%), urinary incontinence (28%), collapse (6%), rib fractures (4%), etc. [10]. It should be noted that there is “insufficient alertness” regarding whooping cough among “adult” doctors, which is why the diagnosis in adults is often established at a late stage of the disease.

Whooping cough is most relevant for infants. Most cases of fatal outcome and severe course of the disease develop in children of the first months of life. Children under 2 months have an increased risk of fatal outcome. Premature babies, children

with intrauterine growth retardation, pathology of the central nervous system, respiratory system and heart belong to the high-risk group for the development of unfavorable outcomes. In infants, whooping cough occurs with a short catarrhal period, a longer period of spasmodic cough (up to 2 months), reprises may be absent. Coughing attacks may end in apnea. Encephalopathy may develop, which is manifested by loss of consciousness, convulsions, paralysis or paresis of the limbs. According to the literature, in the period from 1997 to 2000, 7,203 cases of whooping cough were registered in children of the first half of life in the USA. Of these, 63.1% of children were hospitalized, 11.8% developed pneumonia, 1.4% had seizures, 0.2% had encephalopathy, and 0.8% of children died [11]. Fatal outcomes were mainly associated with the development of severe pneumonia, pulmonary hypertension, encephalopathy, and multiple organ failure. Children with leukocytosis greater than 50,000×109 /L have a 10-fold higher risk of death. Rare complications of whooping cough include pneumothorax, emphysema, subarachnoid and intraventricular hemorrhage, subdural and epidural hematomas, tongue tie ulcer, diaphragmatic rupture, umbilical and inguinal hernia, rectal prolapse, severe alkalosis and associated tonic seizures, and dehydration [9, 10, 11].

Diagnosis of whooping cough is based on epidemiological and clinical laboratory data. All patients who have been coughing for more than 7 days are subject to mandatory laboratory testing for whooping cough (2 times bacteriological and/or 1 time polymerase chain reaction) [15]. Polymerase chain reaction (PCR) has high sensitivity and is currently the most common method for diagnosing whooping cough. Bacteriological and PCR testing for whooping cough is recommended during the first 3 weeks of the disease. In clinically unclear cases, with negative results of bacteriological and PCR testing, late stages of the disease and in vaccinated individuals, 2-fold serological testing with an interval of 10-14 days by the ELISA method is recommended. Confirmation of the clinical diagnosis

of whooping cough in unvaccinated patients is a single detection of specific IgM and/or IgA , and/or IgG (ELISA), or antibodies in a titer of 1/80 or more (RA). In vaccinated patients, whooping cough is indicated by an increase or decrease by 4 or more times in the level of specific IgG and/or IgA (ELISA), or the level of antibodies (RA) when examining paired sera taken at an interval of at least 2 weeks . Hematological changes (leukocytosis with lymphocytosis and normal ESR) are of great diagnostic and prognostic value in whooping cough.

In the treatment of whooping cough, great importance is attached to regime measures. Long walks in the fresh air and a protective regime are recommended. The following are subject to hospitalization: infants regardless of the severity of the disease; patients with severe and complicated forms of whooping cough; children with concomitant pathology (perinatal encephalopathy, convulsive syndrome, prematurity, grade II-III hypotrophy, congenital heart disease, bronchial asthma). According to epidemiological indications, children from "closed groups" (orphanages, camps, hostels, etc.) are hospitalized. Children with apnea, convulsions, respiratory failure should be hospitalized in the resuscitation and intensive care unit.

All patients with suspected whooping cough should begin etiotropic therapy without waiting for the results of the examination. The drugs of choice are macrolides . Azithromycin is prescribed at 10 mg / kg per day as a single dose for 5 days. In children over 6 months, clarithromycin suspension can be prescribed at a dose of 7.5 mg / kg per os for 7 days. Macrolides can prevent or weaken the clinical manifestations of whooping cough if they are used during the incubation period or in the early catarrhal stage.

During the paroxysmal phase of the disease, antimicrobial drugs do not change the clinical course, but can eliminate bacteria from the nasopharynx and thus reduce their transmission [10]. If macrolides are contraindicated,

trimethoprim-sulfamethoxazole can be prescribed . In severe forms of the disease, the use of 3rd generation cephalosporins is recommended. Antibiotics are most effective when prescribed in the early stages of the disease. Non-narcotic antitussive drugs (butamirate) are used in the treatment of whooping cough. In severe whooping cough, mechanical ventilation, oxygen therapy and hormonal therapy (dexamethasone, prednisolone) are performed. There is data on the effectiveness of double exchange blood transfusion and extracorporeal membrane oxygenation in severe forms.

Anti-epidemic measures include isolation of the patient. Patients with whooping cough are isolated for 25 days from the onset of the disease. Contact children under 14 years of age with a cough, regardless of their vaccination history, are subject to suspension from attending preschool and general education institutions until two negative bacteriological results and/or one negative PCR test result are obtained . In family outbreaks, contact children are placed under medical observation for 14 days. Prevention of whooping cough in children in the first months of life consists of preventing contact with any "coughing" patients. Newborns in maternity hospitals, children in the first three months of life, and unvaccinated children under 1 year of age who have had contact with a patient with whooping cough are given normal human immunoglobulin intramuscularly [11]. After isolating the patient, all contacts are recommended to take macrolides for 7 days in an age-appropriate dosage.

Vaccination remains the most effective means of protection against whooping cough. Vaccination begins at the age of three months and consists of three injections of adsorbed pertussis-diphtheria-tetanus vaccine (DPT) at intervals of 1.5 months. Revaccination is carried out 1.5-2 years after the vaccination course. DPT is a whole-cell vaccine and consists of a suspension of killed whooping cough microbes and purified tetanus and diphtheria toxoids adsorbed on aluminum

hydroxide. The whole-cell vaccine " Tetracoc " (adsorbed vaccine for the prevention of diphtheria, tetanus, whooping cough and poliomyelitis) is also used for vaccination against whooping cough . Vaccination with whole-cell vaccines is contraindicated if the child has progressive pathology of the nervous system, a history of afebrile seizures, complications or a strong general reaction (fever in the first two days to 40°C and above) to the previous administration of the vaccine. Currently, acellular (acellular) vaccines are widely used to prevent whooping cough, which are less likely to cause side effects. Acellular vaccines include: Infanrix (a vaccine for the prevention of whooping cough, diphtheria and tetanus), Pentaxim (a combination vaccine containing adsorbed acellular pertussis-diphtheria-tetanus vaccine, inactivated polio vaccine and a vaccine for the prevention of Haemophilus influenzae infection), Infanrix HEXA (a recombinant vaccine for the prevention of whooping cough, diphtheria, tetanus, poliomyelitis, Haemophilus influenzae infection, viral hepatitis B). Vaccination against whooping cough prevents the disease in most cases, however, 3-5 or more years after vaccination, the intensity of post-vaccination immunity decreases, and vaccinated people can get sick. Whooping cough in vaccinated people is mostly mild, specific complications develop 4 times less often than in unvaccinated people, and fatal outcomes are not observed. In the USA and most European countries, vaccination against whooping cough begins at 2 months of age, a 2nd revaccination with an acellular vaccine is carried out at preschool age, and adolescents and adults, including pregnant women, are also vaccinated. According to V.K. Tatochenko (2014), in order to boost immunity against whooping cough, it is necessary to introduce a 2nd revaccination of children aged 4-6 years into the National Immunization Calendar of our country [3].

Thus, at present, despite high vaccination coverage, there is a significant increase in the incidence of whooping cough in children and adults worldwide. In connection with the current epidemic situation, it is necessary to improve the

strategy of vaccination against whooping cough, maintain high coverage with timely vaccination and revaccination against whooping cough in children, strictly adhere to anti-epidemic measures in foci of infection and widely use modern methods of laboratory diagnosis of whooping cough in all patients with a long-term cough.

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