

Study of Infectious Diseases Among Children of Kindergarten Age

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Abstract. The review is devoted to the analysis of the incidence of whooping cough in children in the age group of 5–7 years, as well as immunization strategies with DTP drugs in foreign countries. Mass vaccination against whooping cough began in the middle of the 20th century, which contributed to a decrease in morbidity and mortality from this infection, but in the last decade there has been an opposite trend, consisting in an increase in the proportion of patients among preschool, school-age children and adults

Keywords: acellular whooping cough vaccine, whooping cough, revaccination against whooping cough, safety of whooping cough vaccine, immunity to whooping cough.

Introduction

Whooping cough is an acute infectious disease caused by the bacterium *Bordetella pertussis*, spread by airborne droplets and characterized by convulsive paroxysmal cough and a high degree of mortality in children. Vaccination of children against whooping cough began in 1959–1960. throughout the world, including in our country, has led to a decrease in the level of morbidity and mortality from this infection. This also contributed to a change in the severity of the clinical course of pertussis infection. But at the same time, in children with concomitant neurological pathology, vaccination in a number of cases led to a deterioration in health or was accompanied by the development of unusual reactions, since the pertussis component included in the DTP drug retained its neurotropic properties. The consequence of this was a wave of parents' refusal to vaccinate, and in 1980–1990.

Materials And Methods

If we consider the number of whooping cough cases in the group of children in the first years of life, then the maximum incidence rates are observed in children under 1 year of age, who, as a rule, are not vaccinated or have not completed the course of vaccination. At the same time, in children 3–6 years old, the incidence of whooping cough is minimal, apparently due to immunity formed by vaccination. However, the absolute number of whooping cough cases is highest in the group of children 7–14 years old. This is clearly visible when considering the proportion of sick children under 17 years of age. The majority of cases in 2014 were schoolchildren 7–14 years old - 37.96%, children under 1 year old - 25.0%, children 3-6 years old - 18.17%, children aged 1-2 years old - 15.28 %. That is, more than half of the cases of whooping cough (56.13%) were recorded in children aged 3 to 14 years [2].

But it is worth considering that these incidence rates do not reflect the real situation regarding whooping cough. There is a clear error associated with incorrect diagnosis of the disease. The magnitude of the underreporting of morbidity can be assessed by comparing all-Russian data with data where laboratory verification of the diagnosis is carried out in three-quarters of registered patients [in half of them, using polymerase chain reaction (PCR)]. Incidence rates consistently vary by a factor of 3–5, and it has been established that only 1–36% of all whooping cough cases are actually diagnosed.

Results And Discussion

Clinical course of the disease, complications

Typical forms of the disease include 4 successive periods: incubation period (from 3 to 14 days), prodromal (catarrhal) period (from 3 to 14 days), period of spasmodic cough (from 2-3 to 6-8 weeks and more) and the period of early (from 2 to 8 weeks) and late (from 2 weeks to 6 months) convalescence.

The course of the disease in severe and moderate forms is most often observed in children under the age of 1 year. Moreover, among children of this age, severe forms of the disease in most cases occur in unvaccinated

patients. In children under 1 year of age, the disease is characterized by a shortened or completely absent catarrhal period, the presence of repeated apnea, vomiting, convulsions, a longer period of spasmodic cough, and frequent complications are observed, among which pneumonia and intestinal dysbiosis predominate.

Whole cell and acellular pertussis vaccine

Vaccination against whooping cough in the world is carried out together with the vaccine against diphtheria and tetanus as part of the DTP drug. The very first such vaccine was released in the USA in 1914 and became available for use in mass vaccination in 1948. It was a whole-cell pertussis vaccine associated with tetanus-diphtheria vaccine (TDTV). During the production of the pertussis component, toxins were inactivated by moderate heating followed by storage at low temperatures using merthiolate, which is a derivative of mercury, or formaldehyde as preservatives [3]. Then, tetanus and diphtheria toxoids were added to the almost finished vaccine, obtaining an ATDC drug. Further studies showed that the use of this vaccine reduced the incidence of whooping cough from 70 to 90% [4].

Used acellular pertussis vaccines

Today, both acellular and whole-cell vaccines are used in the world, with the latter predominant. In developed countries, such as the USA, only acellular vaccines are included in the National Vaccination Calendar. Among them, there are 5 drugs that have been tested and recommended for use in children of various ages. Their main difference lies in the different composition and quantity of antigens. In addition to the pertussis components themselves, such preparations contain diphtheria and tetanus toxoids [5].

The effect of revaccination in foreign countries

According to the national vaccination calendar, vaccination against whooping cough in Russia is carried out in several stages. The first, second and third vaccination against pertussis is carried out as part of 3 doses of the DTP vaccine, starting at the age of 3 months and with a break of 4-6 weeks between doses. Revaccination is carried out a year later, when the child turns 18 months old. Subsequent revaccinations against pertussis using acellular vaccines are carried out optionally, since they are not included in the National Vaccination Schedule [2].

Vaccine-induced immunity to whooping cough

In the last 15–20 years, the exclusive role of cellular immunity in the immune response in all types of pertussis vaccines has been shown [3]. Moreover, the immunogenicity of the vaccine depends on its type. Thus, when a whole-cell vaccine is administered, the immune response occurs with the participation of Toll-like receptor type 4 (TLR4), associated with CD4-positive T helper type 1 (Th1) and IL-17 producing T helper cells (Th17). If we consider an acellular vaccine, then the immune response is carried out by CD4-positive T helper type 2 (Th2) and Th1 cells to a lesser extent [4]. It has been found that optimal protection against pertussis is provided by a Th1/Th17 cellular response rather than a Th1/Th2 response [3]. This may explain the fact that the acellular vaccine has a shorter duration of protection compared to the whole cell vaccine. In addition, it has been shown that the administration of whole-cell pertussis vaccine, in contrast to acellular pertussis, leads only to a short-term increase in the level of total IgE and specific IgE to vaccine components, which is especially important when vaccinating children with allergic changes in reactivity [1]. The fourth or fifth booster dose of acellular vaccine significantly increases Th2 cell responses and IgE production, leading to local reactions at the injection site, including skin hyperemia and soft tissue edema and infiltration [3].

Conclusion

Mass vaccination with pertussis drugs has led to a significant reduction in morbidity and mortality from pertussis worldwide. However, the use of modern pertussis vaccines has caused the emergence of new trends, namely: an increase in atypical forms of whooping cough, an increase in morbidity among adolescents and adults due to short-term immunity after vaccination with acellular preparations, the spread of more virulent bacteria *B. pertussis* with antigenic mutations, allowing the pathogen to evade post-vaccination immunity. Such high incidence rates in recent years can also be explained by the fact that more modern methods of detecting the pathogen are increasingly used to diagnose the disease.

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