IDENTIFICATION OF THE CAUSES OF MENINGOCOCCAL INFECTION IN CHILDREN AND IMPROVEMENT OF PREVENTIVE MEASURES

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Annotation.Meningococcal infection is one of the most severe, rapidly progressing, and life-threatening diseases in children. This study focuses on the clinical manifestations of meningococcal infection, its early diagnosis, modern treatment methods, and preventive measures. In addition, the main principles of care for children affected by meningococcal infection, immunization approaches, and epidemiological control methods are discussed. Early diagnosis and effective prevention significantly reduce mortality and complication rates among children.

Keywords: meningococcal infection, children, prevention, care, meningitis, sepsis, immunization, bacterial infection, vaccination, epidemiological control.

ВЫЯВЛЕНИЕ ПРИЧИН ВОЗНИКНОВЕНИЯ МЕНИНГОКОККОВОЙ ИНФЕКЦИИ У ДЕТЕЙ И СОВЕРШЕНСТВОВАНИЕ ПРОФИЛАКТИЧЕСКИХ МЕР

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Аннотация. Менингококковая инфекция является одной из наиболее тяжело протекающих, быстро развивающихся и опасных для жизни заболеваний у детей. В данной работе уделяется внимание клиническим признакам менингококковой инфекции, ее ранней диагностике, современным

методам лечения и мерам профилактики. Кроме того, освещаются основные принципы ухода за детьми, заболевшими менингококковой инфекцией, методы иммунизации и эпидемиологического контроля. Ранняя диагностика и эффективная профилактика значительно снижают показатели смертности и осложнений среди детей.

Ключевые слова: менингококковая инфекция, дети, профилактика, уход, менингит, сепсис, иммунизация, бактериальная инфекция, вакцинация, эпидемиологический контроль.

Аннотатсия. Менингокок инфекцияси болаларда оғир кечувчи, тез ривожланадиган ва ҳаёт учун хавфли касалликлардан биридир. Ушбу мавзуда менингокок инфекциясининг клиник белгилари, эрта аниқлаш, замонавий даволаш усуллари ва касалликнинг олдини олиш чораларига эътибор қаратилади. Шунингдек, менингокок инфекциясига чалинган болаларни парвариш қилишнинг асосий тамойиллари, иммунизатция ва эпидемиологик назорат усуллари баён этилади. Касалликнинг эрта ташхиси ва самарали профилактикаси болалар ўртасида ўлим ва асоратлар кўрсаткичини сезиларли даражада камайтиради.

Калит сўзлар: менингокок инфекцияси, болалар, профилактика, парваришлаш, менингит, сепсис, иммунизатция, бактериал инфекция, вакцинатция, эпидемиологик назорат.

Introduction. Meningococcal infection is a severe and dangerous disease caused by the bacterium *Neisseria meningitidis*, which occurs primarily in children. The infection may manifest in serious forms such as meningitis, sepsis, and meningoencephalitis, posing a life-threatening risk within a short period of time. Therefore, early detection, preventive measures, and proper care are of great importance.

Meningococcal infection is an acute contagious disease caused by meningococci. The main source of infection is an infected person, most commonly asymptomatic carriers, who transmit the bacteria to others through airborne droplets.

The infection is more frequently observed in winter and spring, which are considered periods of seasonal increase.

Relevance. Meningococcal infection may present as inflammation and damage to the nasal and pharyngeal mucosa (nasopharyngitis), purulent inflammation of the meninges (purulent meningitis), inflammation of the brain tissue together with the meninges (meningoencephalitis), or as meningococcemia, which occurs when meningococci enter the bloodstream. In many cases, all of these forms may develop in the same patient.

Often, meningococcal carriage is observed without any clinical symptoms. This condition is particularly dangerous, as individuals with mild inflammatory signs such as runny nose, cough, and sneezing (nasopharyngitis) can rapidly spread the pathogen.

In nasopharyngitis, the patient may experience sore throat and burning sensation, dry cough, nasal congestion, and mucous–purulent or sometimes blood-streaked nasal discharge. Additional symptoms may include dizziness, headache, fever, and occasional nosebleeds.

The purpose. When meningococcal infection is suspected, swabs are taken from the throat and nose, and cerebrospinal fluid is collected for examination. Depending on the localized form of the disease, meningococcal carriage and meningococcal nasopharyngitis are classified as local types of infection, while meningococcemia and meningococcal meningitis are considered generalized forms.

Tasks. Meningococcal infection usually begins with the following symptoms:

• A sudden rise in body temperature• Headache• Vomiting• Skin and mucosal rashes• Impaired consciousness, seizures• Neck stiffness

The main part. One of the main measures in preventing meningococcal infection is vaccination. Polyvalent meningococcal vaccines (against groups A, C, W, Y, and B) significantly reduce the risk of disease development in children.

Meningococcal infection is a serious public health problem in most countries worldwide. It is associated with various clinical forms, frequent fatal outcomes, severe disease progression, and cases leading to disability among those who have recovered from the infection [10].

Over the past 10 years, a decline in meningococcal infection incidence has been observed; however, this does not rule out the possibility of epidemics or pandemics. The epidemic periodicity of meningococcal infection is characterized by a wave-like long-term dynamic pattern, with cycles typically recurring every 10–30 years. During inter-epidemic periods, a reduction in meningococcal infection incidence is usually observed [6, 8, 10].

In Uzbekistan, such periodicity has persisted for about 30 years, which in turn leads to decreased alertness among healthcare workers regarding this infection. Delayed diagnosis, late hospitalization, and often untimely medical care contribute to various complications or fatal outcomes among patients [4, 9].

Long-term monitoring of meningococcal infection incidence in Uzbekistan (observations from 1970 to 2018) shows that the disease was recorded mainly in sporadic cases caused by meningococci belonging to serogroup A. Multiple meningococcal serogroups are known to cause the most severe and widespread forms of meningococcal infection (generalized meningococcal infection, GMI) [10, 11].However, the current epidemiological situation has changed to some extent. In several countries (Taiwan, South Africa, China, Brazil, Argentina, Chile, the United Kingdom, the Russian Federation), cases of meningococcal infection have been reported to be caused by the highly virulent and antibiotic-resistant mutant strain B135. This strain also demonstrates population (community) immunity.

The high proportion of severe clinical forms of meningococcal infection observed in many countries indicates that we may be approaching another epidemic rise of meningococcal disease [7, 2].

Currently, the epidemiological surveillance of meningococcal infection in different countries is conducted through several regional systems. Control, prevention, and epidemiological monitoring of meningococcal infection are implemented by various organizations, with the Centers for Disease Control and Prevention in the United States being a leading authority.

According to the classification of the, the average incidence of meningococcal infection (<10 cases per 100,000 population per year) is observed in 18 European countries, with low incidence in some countries (<2 cases per 100,000 population per year). The highest prevalence of various forms of meningococcal infections has been recorded in the top 25 countries worldwide [5].

In the context of increasing global interconnectedness, it is important not only to account for cases within a country but also to monitor them across borders and at the global level.

The international meningococcal initiative was established in 2009, aiming to prevent the spread of meningococcal infection at the global and regional level. The initiative involves over 70 experts, including clinicians, immunologists, epidemiologists, microbiologists, public health specialists, and vaccination experts. Since its inception, global regional meetings have been held to study pressing issues comprehensively and to implement regional recommendations [1, 2, 5].

The epidemiology of meningococcal infection varies significantly by geographic region and time. Incidence rates of meningococcal infection range from <0.5–0.9 cases per 100,000 population in some regions, up to 10,000 per 100,000 in North America and Europe, and 100,000 per 100,000 in the African meningitis belt. Meningococcal infections often occur sporadically, occasionally as epidemics, or frequently in the form of localized outbreaks. Currently, the highest incidence rates are observed in the african meningitis belt south of the Sahara [58].

At present, meningococcal infection has been reported in more than 150 countries worldwide. The highest incidence rates are recorded in African countries, particularly in Central and West Africa. This hyperendemic region stretches from

southern parts of the Sahara, west to Senegal, and east to Ethiopia, covering 14 countries [12]. The African meningitis belt includes 26 countries. In this zone, the incidence is usually high, with annual cases ranging on average from 7,000 to 180,000.

In Uzbekistan, the decline in meningococcal infection incidence during the inter-epidemic period, which has persisted for over 30 years, has led to decreased vigilance among healthcare workers regarding meningococcal infection. As a result, delayed diagnosis and hospitalization, often coupled with untimely medical care, have contributed to various complications in patients.

Currently, data indicate high virulence and prominent circulation of *N. meningitidis* serogroup A, as these strains often cause the generalized forms of meningococcal infection[1].

Epidemic cases of meningococcal infection in Uzbekistan are characterized by inter-epidemic period features. The highest disease burden is observed among patients aged 7–14 years (17.9%) and 20–29 years (39.8%).

Among laboratory-confirmed cases, the primary causative agent is *N. meningitidis* serogroup A (99.1%). In previous years, cases caused by *N. meningitidis* serogroup W135 have been observed. These cases are often associated with persistent hyperthermia and characteristic hemorrhagic rash, which appears only on days 3–4 of illness, making timely diagnosis significantly more difficult and specific to meningococcal infection.

Epidemic events recorded in Uzbekistan during the 1970s show the long-term dynamics of meningococcal infection incidence (1970–2018). Epidemics caused by serogroup A meningococci accounted for the largest proportion of cases (Khojaev Sh.Kh., Sokolova I.A., 1972–1975). From 1978 to 2018, serogroup A cases were primarily sporadic[1, 2].

Region	Female	%	Male	%

Uzbekistan (n=232)	80	34.48 ± 0.38	152	65.52 ± 0.53*
Tashkent city (n=140)	40	28.57 ± 0.45	100	71.43 ± 0.71*
Tashkent region (n=25)	8	32.00 ± 1.13	17	68.00 ± 1.64*
Republic of Karakalpakstan (n=24)	7	29.17 ± 1.10	17	70.83 ± 1.71*

Gender distribution of meningococcal infection cases in Uzbekistan and selected regions of the Republic (2016–2025)

Due to migration processes among the population, individuals arriving from countries with high meningitis risk may negatively impact the epidemiological situation in the region. In recent years, cases of atypical meningococcal infection have been reported.

Generalized forms of meningococcal infection and the absence of pathognomonic signs in the initial hours of illness make early diagnosis challenging. This can lead to delayed hospitalization, development of complications, and reduced effectiveness of intensive care measures. However, despite the acute and sometimes severe course of the disease, knowledge of the current epidemiological characteristics of meningococcal infection allows for timely diagnosis and appropriate urgent interventions, thereby reducing the risk of adverse outcomes [6, 9].

CONCLUSIONS. As shown by long-term observations, modern meningococcal infection in Uzbekistan has the following epidemiological features:

- MI is observed in all age groups of patients (the age range varied from 40 days to 76 years). The peak of the disease occurred in the months of March-April, however, there is a year-round incidence of meningococcal infection;

- in the event of sporadic cases of meningococcal infection, serogroup A meningococci prevail; 78.0% of those with MI are residents of the city of Tashkent;

- children aged 0 to 5 are much more common (17.3% of the total number of hospitalized), but their share has decreased compared to previous decades;

- there is “growing up” in the age structure of morbidity, i.e. there is currently an increase in the incidence among adults (20 years and older).

The largest number of patients were persons aged 20 years. Persons from 16 to 20 years old accounted for 15.7%, and from 21 to 25 years old - 16.5%. - as for the sex of those with MI, 74.0% were males, and 26.0% were females;

- it is necessary to monitor MI strains in order to prevent the emergence of new highly virulent strains of meningococci on the territory of the republic;

- It is necessary to make a decision to increase the coverage of the population with vaccinations to prevent a further increase in the incidence of meningococcal infection in Uzbekistan.

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