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**MEASLES (LAT. MORBILLI) – ETIOLOGICAL CLINICAL TREATMENT**

**Turdiyev Tuymurod Utkir ugli**

Email: turdiyevtuymurod92@gmail.com

<https://orcid.org/0009-0003-5191-7927>

Bukhara State Medical Institute named after Abu Ali Ibn Sino, Uzbekistan, Bukhara city.  
A.Navoiy street 1 Tel:+998(65) 223-00-50 e-mail: mail.bsmi.uz

Measles is an acute infectious disease of viral etiology with an extremely high degree of contagiousness.

The causative agent is the measles virus, belonging to the Paramyxoviridae family, genus Morbillivirus.

The clinical picture of measles is characterized by the development of fever reaching high values (up to 40.5 ° C), inflammation of the mucous membranes of the oral cavity (including the so-called Belsky-Filatov spot), upper respiratory tract, conjunctivitis, as well as a characteristic maculopapular rash on the skin. The disease is accompanied by severe intoxication, general weakness and sometimes progressive complications such as pneumonia, encephalitis or diarrhea. According to the World Health Organization (WHO), in 2018, about 140 thousand people died from measles worldwide, most of whom were children under five years of age. Despite significant progress in global vaccination, measles remains one of the leading causes of childhood mortality in developing countries, accounting for 1.3% of all child mortality in 2016. The sharp increase in measles cases in 2017 is due to insufficient vaccination coverage and decreasing herd immunity, which has led to measles outbreaks in various regions of the world. Gaps in immunization remain a key factor contributing to the spread of the infection. In the Russian Federation, the incidence of measles in 2018 was 1.7 cases per 100,000 people, indicating the presence of localized outbreaks of the disease despite existing prevention measures.

**Etiology .**

The causative agent of measles is an RNA-containing virus belonging to the genus Morbillivirus of the family Paramyxoviridae. The virus has a spherical shape with a diameter of 120 to 230 nm. Its genetic material is represented by a minus-strand molecule of single-stranded RNA, which is wrapped in a nucleocapsid consisting of several proteins. The outer shell of the virus includes a matrix protein and two surface glycoproteins: hemagglutinin (H) and fusion protein (F), which play a key role in binding the virus to cellular receptors and the process of fusion of the virus with the cell membrane. The measles virus remains active in the air and on surfaces for up to two hours, but is unstable in the external environment. It is quickly inactivated by physical and chemical factors such as ultraviolet radiation, high temperatures (eg, boiling) and disinfectants. There is a hypothesis that the measles virus originated from the rinderpest virus, which arose during the

development of livestock farming. This theory is based on the similarity of the genetic structure of the viruses and the supposed transmission of the virus from animals to humans through contact with livestock. Despite its instability to the effects of the external environment, the measles virus is capable of spreading over significant distances in the air, especially through ventilation systems in closed premises, which contributed to epidemics of the disease, especially in the cold season. Weakened strains of the measles virus are used to create a live measles vaccine, which provides effective prevention of the disease.

### Spread.

Measles is transmitted by airborne droplets. The virus is released into the environment in large quantities by a sick person, mainly when coughing, sneezing and other forms of mucus secretion. The disease is characterized by extremely high contagiousness, which is 90%. This means that each sick person infects nine out of ten people who are not immune to measles and who are in contact with him. The source of infection is a person sick with measles in any form. The patient is contagious from the last days of the incubation period (the last 4 days) until the 4th day of the rash. After this, starting from the 5th day of the rash, the person is considered not contagious. The  $R_0$  (basic reproductive number) of measles is from 12 to 18. This means that each infected person can transmit the virus to at least 12-18 other people.  $R$  is a statistical value reflecting the contagiousness of the disease. Before mass vaccination, measles mainly affected children aged two to five years, while adults who had not had the disease as children were much less likely to develop the disease. According to the European Centre for Disease Prevention and Control, between 2006 and 2016, in the European Union, 25-50% of measles cases occurred in children aged one to nine years, 20-50% of cases occurred in people over 20 years old, and 5-15% occurred in children under one year old. Newborns born to mothers who have had measles have innate immunity, also called colostral immunity, which they receive through the placenta or colostrum. This passive immunity lasts for the first six to nine months of life. Children whose mothers were vaccinated against measles have passive immunity for a shorter period. In rare cases, congenital measles can develop when the virus is transmitted transplacentally from an infected mother to her fetus. After the disease, a stable immunity develops, which makes re-infection extremely unlikely in the absence of pathologies of the immune system. However, cases of re-infection have been described. The incidence of measles is highest in the winter-spring period (December-May), with a cyclical increase in incidence every 2-4 years. In countries with a high level of measles vaccination coverage, the disease occurs mainly in the form of localized outbreaks (an outbreak is considered to be the disease of three or more people) or epidemics affecting tens or hundreds of people. Cases when more than a thousand people become ill per season remain rare.

### Microscopic picture:

Mucosa of the respiratory tract: Edema, vascular congestion, foci of necrosis, areas of epithelial metaplasia, focal lymphohistiocytic infiltration in the submucosal layer.

Reticuloendothelial system: Presence of giant multinucleated Wartinen-Finkeldey cells containing viral inclusions.

Skin: Changes in the papillary layer of the dermis, manifested by edema, vascular congestion, hemorrhages, perivascular lymphohistiocytic infiltration. Foci of necrosis can also be found in the epidermis.

These morphological changes are the basis for the diagnosis of measles at the microscopic level and characterize the systemic nature of the viral infection of the body.

### **Classification of measles**

By type:

Typical — a disease with a characteristic clinical picture, including catarrhal symptoms, rashes and typical complications.

Atypical — includes several variants, such as:

oMitigated — a form with moderate symptoms or with less pronounced manifestations.

oAbortive — a form with a short and mild course, where symptoms may be limited or undeveloped.

oAbsent — a form with barely noticeable or imperceptible symptoms, often complicating diagnosis.

oAsymptomatic — a case when an infected person does not show signs of the disease, but is a source of infection.

oHypertoxic — a severe form, accompanied by severe intoxication, possible fulminant complications.

### **By the clinical period of measles:**

Catarrhal period — the initial stage of the disease, characterized by general intoxication, fever, inflammation of the mucous membranes of the upper respiratory tract, as well as the appearance of Belsky-Filatov spots on the oral mucosa.

Rash period — the stage when a characteristic maculopapular rash appears, starting from the face and spreading over the body.

Pigmentation period — the final phase, when the rash disappears, leaving pigmented areas of the skin that gradually disappear.

### **By severity:**

Mild form — a disease with minimal symptoms and no serious complications.

Moderate form — the presence of moderate clinical manifestations that require medical intervention, but do not lead to fatal consequences.

Severe form — a disease with pronounced symptoms, accompanied by complications such as pneumonia, encephalitis, or other serious conditions that threaten the patient's life.

**By the course of the disease:**

Smooth course — the disease proceeds without significant complications, with the usual development of clinical stages and recovery.

Rough course — complicated course with additional pathological conditions, such as:

oComplications (encephalitis, meningitis, pneumonia, etc.).

oOverlay of a secondary bacterial infection, which significantly worsens the patient's condition.

oWorsening of chronic conditions such as asthma or heart disease, which can make treatment more difficult and worsen the prognosis.

**Clinic**

The clinical picture of measles is characterized by several characteristic stages, starting with the incubation period and ending with the stage of regression of skin rashes. The incubation period of measles usually lasts from 8 to 17 days, but in patients who have received immunoglobulin, blood components or plasma, it can be extended to 21 days. The disease begins acutely, with a rise in body temperature to 38-40 ° C, accompanied by a dry cough, rhinitis, photophobia, sneezing, hoarseness, headache, swelling of the eyelids, redness of the conjunctiva, hyperemia of the mucous membrane of the pharynx and measles enanthem - the presence of red spots on the hard and soft palate. One of the pathognomonic signs of measles is the appearance of Belsky-Filatov-Koplik spots on the second day of the disease. These small whitish formations, surrounded by a red border, are located on the inner surface of the cheeks in the area of the molars and are a specific symptom of measles. On the 4th-5th day of the disease, a measles rash (exanthema) appears on the skin, which begins with the face, neck and area behind the ears, and then spreads to the body. On the third day, the rash covers the extensor surfaces of the arms and legs, including the fingers. The rash consists of small papules surrounded by hyperemic areas that tend to merge. This is a characteristic difference from the rash with rubella, where the elements of the rash do not merge. The regression stage of the rash begins on the 4th day of the rash. Body temperature normalizes, the rash darkens, turns brown and pigmented, while the elements of the rash gradually peel off. This process occurs in the same sequence as the development of the rash. Pigmentation persists for one to one and a half weeks after the disappearance of the rash. Measles infection can cause a number of serious complications affecting various body systems, which are associated with immune dysfunction and the spread of the virus through various organs and tissues. Among the most common complications are inflammation of the upper respiratory tract, including laryngitis, croup (laryngeal stenosis), bronchitis, and tracheitis. Inflammatory diseases of the ears (otitis) and sinusitis are also common. One of the most dangerous complications is pneumonia, which can be either primary (viral) or secondary (bacterial). Rarer but extremely serious complications include measles

encephalitis, which is characterized by inflammation of the brain, and mesenteric lymphadenitis, inflammation of the lymph nodes located in the mesentery of the intestine.

### **Complications.**

Another rare but extremely severe late complication is subacute sclerosing panencephalitis, a chronic and progressive inflammatory disease of the brain that develops several years after measles and leads to disability and death. The effect of measles on the central nervous system can also manifest itself in the form of meningitis, as well as liver dysfunction, including measles hepatitis. These complications require careful monitoring and complex treatment.

### **Treatment**

To date, there is no specific treatment for measles, and therapy is limited to symptomatic treatment aimed at alleviating the patient's condition and preventing complications. Symptomatic therapy includes the use of expectorants and mucolytic drugs, as well as anti-inflammatory aerosols, which help to alleviate inflammatory processes in the respiratory tract. Antipyretic drugs such as ibuprofen or paracetamol are used to reduce fever and relieve pain. However, the use of aspirin in children with measles is not recommended, since according to some studies, it may be associated with the development of Reye's syndrome, which leads to damage to the liver and brain. However, this connection remains a subject of debate, and in most cases, doctors adhere to the recommendation to avoid the use of aspirin in children under 16 years of age for acute infectious diseases with fever. In addition, enterosorbents can be used to reduce the level of proinflammatory cytokines that promote inflammation, which helps alleviate the course of the disease and reduce the likelihood of complications. To eliminate itching of the skin during measles, daily rinsing and washing the body with a solution of Delaskin powder (synthetic tannin) is recommended, which helps reduce inflammation and discomfort. To wash the eyes during the disease, you can use a solution of baking soda or strong tea, and in the development of conjunctivitis - drops with antibiotics such as chloramphenicol (0.25%) or albucid (20%). Various antiseptic solutions are recommended for rinsing the mouth, such as chamomile infusion, tea, chlorhexidine solution, soda solution with salt, as well as furacilin solution, which helps reduce inflammation and prevent infectious complications in the oral cavity. In the development of bacterial complications, such as pneumonia, antibiotics are mandatory. In severe cases with the development of croup, i.e. stenosis of the larynx, corticosteroids are indicated to reduce inflammation and facilitate breathing. In addition, the World Health Organization (WHO) recommends vitamin A therapy, which helps reduce the risk of complications to the eyes and reduce mortality from measles by 50%.

### **Literature**

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