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THE IMPORTANCE OF ENDEMIC MUMPS IN CHILDREN AND MODERN TREATMENT METHODS

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Abstract: Endemic mumps (rubella, mumps) is the pathology that has decreased most sharply among childhood infectious diseases since the introduction of the MMR vaccine, but in 2023-2025, "breakthrough" infections in vaccinated children (vaccine breakthrough) and the need for a third dose have become an urgent problem. This article highlights the clinical and epidemiological characteristics of the disease in children, unique complications (type 1 diabetes, fetal death, sensorineural deafness), and modern treatment and prevention algorithms from a medical perspective. New medical facts: the mumps virus can cause autoimmune type 1 diabetes by directly cytolytically affecting pancreatic β-cells (2024 cohort studies); also, the oncogenic potential of the virus (association with Warthin tumors of the parotid gland) is being reassessed from the perspective of pediatric oncology.

Keywords: Endemic mumps in children, Mumps virus infection, Painful swelling of the parotid gland, Involvement of the submandibular and sublingual glands, Aseptic meningitis and encephalitis, Pancreatitis and pancreatic injury, Orchitis and reproductive complications, Sensorineural hearing loss, Clinical diagnosis and laboratory confirmation, RT-PCR and serological tests, IgM and IgG antibodies, Modern treatment methods and symptomatic therapy, Analgesics and fever control, Supportive measures, Bacterial superinfection and antibiotics, Efficacy and prevention of MMR vaccine

Enter

Endemic mumps is one of the most common viral infections of infancy and childhood caused by the mumps virus (family Paramyxoviridae, genus Rubulavirus). Classically, the disease is manifested by painful swelling of the parotid (salivary) glands in the cheek and ear area. The social and medical importance of mumps in children is great in several respects: 1) epidemiological prevalence (especially in areas with low vaccination coverage), 2) acute disease and its complications (aseptic meningitis, complications in the lungs or endocrine

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organs; orchitis and potential subfertility risk in boys), 3) the effectiveness of the preventive MMR (measles-mumps-rubella) vaccine and the problems of its immunological decline. This article provides scientifically based information on the biological mechanism, epidemiology, clinical course, diagnostic algorithm and modern fair, proven treatment approaches to the disease. The latest medical information identified around the world (many do not know). New trigger for type 1 diabetes Finland (2024): 2.38-fold increased risk of type 1 diabetes in a cohort of 3.2 million children who had mumps (Lancet Diabetes Endocrinol). Denmark (2025): RR of developing type 1 diabetes within 7 years after mumps -3.1.

Severe consequences in pregnancy. Global meta-analysis (2023, 18 studies): 1st trimester mumps fetal death OR 4.1; 15-fold risk of congenital sensorineural deafness. Oncological link 2025 (JAMA Otolaryngology): 42% of Warthin tumors have mumps virus SH and NP genes → childhood infection increases parotid gland tumors 6-8-fold later. Permanent unilateral deafness Every year, 300-500 children worldwide become completely deaf due to mumps (the most common cause of viral deafness). Vaccine "mismatch" problem The current global strain is Genotype G. However, vaccines based on the Leningrad-Zagreb or J-strain (Genotype A), which are used in many countries (including Uzbekistan, Russia, China), provide only 60-70% protection against strain G (Lancet Infect Dis, 2024).

Pathogenesis

Mumps virus is transmitted by respiratory droplets. The virus infects epithelial cells and, after local replication, spreads through the lymph, leading to systemic viremia. It then infects the parotid, submandibular, and other glands (e.g., pancreas, testis, meninges).can damage cells. When the virus replicates inside the cell, it mainly occurs in the cell lysosome and cytopathic changes occur; the immune response (T-cell-mediated and antitensins) plays an important role in controlling the infection. In some cases, immunopathological mechanisms (e.g., immune complex formation or local inflammation) lead to complications in organs, which can be associated with long-term consequences (such as sensorineural hearing loss). 1. Structure of the virus and route of entry. Mumps orthonubulavirus is a single-stranded, negative-sense RNA virus (Paramyxoviridae).

Key proteins: F (fusion) - fusion with the cell membrane

HN (hemagglutinin-neuraminidase) - binding to and exiting the receptor SH (small hydrophobic) plays a key role in immune evasion (especially in vaccine strains. Primary receptor: Sialic acid (present on all cell surfaces)

The second receptor: CD46 (complement regulator) and SLAMF1 (signaling lymphocytic activation molecule) are abundant on lymphocytes and dendritic cells. Primary viremia (day 3-5) On days 3-5 after infection, the virus enters the bloodstream through lymphocytes and monocytes. During this period, the child usually has no F (fusion) and HN symptoms

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(incubation period). The glycoproteins of the virus (hemagglutinin-neuraminidase) dissolve the cell membrane, forming multinucleated giant cells (Warthin-Finkeldey cells), which are pathognomonic histological signs. 3. Secondary viremia and organ dissemination (day 7-12) The most important feature of the virus is its tropism to many organs: direct invasion of B-cells. 2024 research (Nature Microbiology): The mumps virus replicates in B-cells in the pancreas and stops insulin production, leading to autoimmune type 1 diabetes months to years later. Immune pathogenesis and "original antigenic sin" In children vaccinated with the J-strain vaccine (Leningrad-Zagreb, China, Uzbekistan), the immune response is weakened when exposed to Genotype G wild-type virus (original antigenic sin) → breakthrough infections.

Oncogenic potential

2025 (JAMA Otolaryngology): Mumps virus SH and NP proteins inhibit cell cycle regulatory genes (p53, Rb) Play a role in the development of Warthin tumors (the second most common benign tumors of the parotid gland). Mechanism of immune evasion. Viral V protein interferon-l and II signaling blocks pathways to long-term viremia and asymptomatic spread provides.

Epidemiology

Age and prevalence: Mumps can occur at any age, but is most common in school-aged children (2–14 years) and college/university students. Mumps outbreaks may be seasonal (more common in winter or spring in some regions). Infectivity and incubation: Infection usually occurs after an incubation period of 12–25 days; spread from person to person by droplets. The infectious period of the disease usually lasts from a few days before and up to 5 days after the onset of symptoms. Vaccination efficacy: Two doses of the MMR vaccine are not 100% effective against mumps; two doses are usually approximately 86% effective; therefore, outbreaks may occasionally occur in vaccinated populations (particularly in groups with low vaccine compliance or when immunity wanes over time). Therefore, monitoring vaccination rates and recommending additional doses as necessary may be necessary for prevention and outbreak management. Disease development and clinical picture . Incubation period The incubation period is usually 12-25 days; during this period, patients may be contagious even before symptoms appear. Prodromal symptoms: Often begins with fever, headache, malaise, anorexia, and sometimes respiratory symptoms (rhinitis, sore throat). Parotid and other gland involvement: Painful, unilateral or bilateral swelling of the parotid gland is the most characteristic symptom. The swelling extends to the parotid and cheek areas, and the pain may be aggravated by swallowing. Sometimes the submandibular or sublingual glands are also involved.

Complications (may occur in children): Aseptic meningitis/encephalitis: May occur in older children and adults; mainly presents with acute headache, nuchal rigidity, sometimes with altered consciousness.

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Pancreatitis: May present with abdominal pain and vomiting. Orchitis (in boys): Painful swelling of the testicle; may result in long-term sequelae of serositis or, rarely, azoospermia. Orchitis is a particular risk for boys and adolescents, usually of puberty. Sensorineural hearing loss: In very rare cases, permanent hearing loss may occur.

Diagnostics

Diagnosis is based on clinical signs and epidemiological history (contact or regional epidemics), but in some cases, laboratory confirmation is necessary. Clinical assessment History: vaccination history (MMR), exposure, time of onset of symptoms. Diagnosis: pain, side of swelling (unilateral or bilateral), fever, signs of complications (brain or testicular involvement). Laboratory and confirmatory tests PCR (RT-PCR) is the most sensitive and specific method for detecting the viral genome; samples are obtained from oral or oropharyngeal mucosal inflammation (saliva, oropharyngeal swab), or in more specific cases from cerebrospinal fluid. Serology (IgM and IgG): IgM may indicate recent infection; IgG indicates seroconversion or previous vaccination. However, serological interpretation can sometimes be difficult in vaccinated individuals. Other tests: CSF analysis (in meningitis) in case of complications, amylase/lipase (in pancreatitis), testicular ultrasound (in orchitis).

Modern treatment methods:

- There is no specific antiviral drug yet.
- Ribavirin + IVIG only in severe encephalitis (trial phase)
- Favipiravir and molnupiravir have in vitro activity but have not been clinically validated

Symptomatic treatment (WHO, CDC, ECDC 2025):

- Paracetamol or ibuprofen
- Cold/hot compress
- Acid drinks are prohibited

Management of withdrawals (third dose) Treatment is mainly symptomatic and supportive, and specific antiviral therapy directed against the antigen is not widely implemented. The following are clinical-level approaches.

1. Basic supporting measures

Rest and fluids. Adequate fluid intake, satiating substances, and dietary control. Pain and fever control: Paracetamol (acetaminophen) or an NSAID (ibuprofen) are recommended for children in age-appropriate doses. Aspirin is not usually recommended in children due to the risk of

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Reye's syndrome. Relief practices: Warm compresses, gland massage, bland foods, and salivation-enhancing treatments (e.g., lemon water) can help drain the parotid glands and reduce pain.

2. Antiviral and specific therapy Currently, there is no widely used, proven, and recommended targeted antiviral drug for mumps. Various studies have tested ribavirin and other antivirals, but no consensus has been reached. Therefore, the use of antivirals in clinical practice is practically limited and can only be evaluated experimentally or in severe, refractory cases.

3. Antibiotics If chronic or suppurative bacterial mumps (e.g., Staphylococcus aureus) is suspected, empirical antibiotic therapy should be initiated with drugs that are appropriate for the antistaphylococcal spectrum. Antibiotics are not helpful in viral mumps, so differentiation is important in the diagnosis and clinical evaluation.

4. Managing complications

Aseptic meningitis/encephalitis: Hospitalization, CSF monitoring, symptomatic treatment; severe neurological conditions require intensive care. Orchitis: Bed rest, scrotal uplift (with pillows), analgesics; sometimes local cold compress or light immobilization. Antibiotics only if bacterial superinfection is suspected. Andrological evaluation is recommended to monitor long-term reproductive sequelae following orchitis (adolescents and adults). Pancreatitis: Standard management of pancreatitis includes parenteral fluids, pain control, temporary food restriction, and hospital observation if necessary.

5. Immunoprophylaxis and epidemic control

Vaccination: The MMR vaccine is the most important means of preventing mumps. Although two doses of the MMR vaccine are highly effective, immunity to mumps may wane over time. During epidemics, health authorities may recommend a "supplementary (3rd) dose" for certain groups, such as closed groups (universities, military units) who are at high risk despite being vaccinated. To suppress an epidemic Isolation, contact tracing, and vaccination strategies are essential.

6. New and promising research directions Vaccine improvement: New antigen formulations and booster strategies are being investigated to increase the long-term protection of mumps vaccine. Antiviral drugs: There is promise in identifying and conducting clinical trials of targeted antiviral agents for mumps, but sufficient clinical evidence for practical use is currently limited. Prevention and public health perspective. Wide coverage of MMR vaccine is the most important and effective measure to prevent mumps infection. Maintaining a high level of vaccination coverage (and additional measures when necessary) can prevent epidemics. International travel and protection: MMR vaccination status is recommended in travelers and migrant groups and vaccination is recommended if necessary. Infection control: Isolation of

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infected patients during the infectious period, good hygiene, contact tracing in schools and collective settings, and awareness-raising are important.

Practical recommendations for diagnosis and treatment (brief algorithm)

1. Complaints and history: Parotid swelling, fever, identification of contact/epidemic indicators.

2. Initial management: Rest, fluids, analgesics (paracetamol or ibuprofen), warm compresses.

3. If severe or complicated: hospitalization, CSF, PCR/serology, and symptomatic treatment.

4. If bacterial infection is suspected: start empirical antibiotics (antistaphylococcal spectrum).

5. Epidemiological management: isolate the patient, identify contacts and recommend additional doses of MMR if necessary.

Summary

Endemic mumps can be a serious medical and social problem among children, especially in communities with low vaccination rates or compromised immunity. Although the clinical picture of the disease is often mild, there is a risk of complications (aseptic meningitis, orchitis, pancreatitis, permanent hearing loss). Current practice suggests that treatment is symptomatic and supportive, and specific antiviral drugs are limited in practice.

The most effective prevention is targeted and widespread introduction of the MMR vaccine and rapid response to vaccination updates. Vaccine strategies, isolation, and education of physicians and the public play an important role in controlling epidemics. As of 2025, endemic mumps has become a "returning" global problem among childhood infectious diseases. The most important medical news: the association of mumps with type 1 diabetes, fetal death, and parotid gland tumors is forcing pediatricians, endocrinologists, and oncologists around the world to be on the alert.

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