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TOPIC: RNA VIRUSES – VIRUSES CAUSING RESPIRATORY DISEASES IN HUMANS: ORTHOMYXOVIRUSES, PARAMYXOVIRUSES, AND CORONAVIRUSES. THEIR CHARACTERISTICS. METHODS OF INDICATION AND IDENTIFICATION. THEIR ROLE IN HUMAN PATHOLOGY.

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Abctract: The article describes the biological characteristics of RNA-containing respiratory viruses that play an important role in the human body, including orthomyxoviruses, paramyxoviruses, and adenoviruses, as well as methods of their laboratory indication and identification. Influenza, parainfluenza, measles, mumps, and coronavirus infection are analyzed in detail.Modern laboratory diagnostic methods, serological tests, and immunofluorescence techniques are of great importance for the early detection of respiratory viral infections, differential diagnosis, and the development of effective preventive measures.

Keywords: RNA viruses, orthomyxoviruses, paramyxoviruses, coronaviruses, respiratory viral infections, influenza, COVID-19, bronchitis, viral pathogenesis, immune response

Introduction:

The Orthomyxoviridae family includes the influenza virus. Three types are distinguished: A, B, and C. Type A causes outbreaks in the form of epidemics and pandemics. In the retrospective diagnosis of influenza, serological methods are most commonly used.

Parainfluenza viruses are more frequently observed in children. The disease usually manifests as laryngotracheobronchitis. Type 3 of the virus can cause bronchitis and pneumonia in children under one year of age.

The mumps virus (epidemic parotitis) is an acute infectious disease that primarily affects the parotid gland and often leads to sudden outbreaks. The mumps virus has only one serovar. The virus initially enters epithelial cells of the upper respiratory tract and damages the mucous membrane, as well as the epithelial cells of the nasopharynx, trachea, and bronchi. As a result of necrosis of these cells, skin rashes may appear. In some cases, the virus can reach the central nervous system and cause encephalomyelitis. Consequently, syncytia (multinucleated giant cells) are formed. Unlike other paramyxoviruses, its structure lacks neuraminidase.

Adenoviruses mainly affect the upper respiratory tract, eyes, intestines, and lymphoid tissues. There are 34 serovars of adenoviruses. They have a simple structure and contain a double-stranded linear infectious DNA. The virus lacks a supercapsid, making it highly resistant to environmental factors such as ether and alcohol. Under laboratory conditions, adenoviruses actively replicate in epithelial cell cultures obtained from humans. Viral replication occurs in the

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nucleus. The cytopathic effect of the virus appears 1–7 days after infection, characterized by rounding of cells and their aggregation into grape-like clusters. Specific DNA-containing inclusions appear in the cell nucleus. Adenoviruses are not pathogenic for chicken embryos or laboratory animals. Some serovars have oncogenic properties.

Main Part:

Materials for virus detection may include nasopharyngeal washings, sputum, and other samples. Before inoculation into cell cultures or chicken embryos, pathological material is treated with antibiotics such as penicillin and streptomycin (1000 IU/ml) and centrifuged to eliminate other microorganisms present in the sample. All virological procedures are carried out in biosafety cabinets under highly sterile conditions.

For the detection of viruses causing acute respiratory diseases, methods such as cytopathic effect (CPE), hemadsorption, hemagglutination (HA), and immunofluorescence are used. Compared to other methods, the immunofluorescence technique allows detection even when viruses are present in very small quantities in the material. In addition, this method enables not only detection but also identification of viruses such as parainfluenza viruses, respiratory syncytial virus (RSV), adenoviruses, and mycoplasmas in infected cell cultures.

After viruses accumulate in cell cultures, adenoviruses can be identified using the complement fixation test (CFT), while parainfluenza, mumps, and measles viruses can be differentiated using hemagglutination inhibition (HI), complement fixation, and neutralization reactions with specific antisera. For virus titration using the hemagglutination reaction, a 1% suspension of erythrocytes is used. During epidemic and inter-epidemic periods, influenza virus strains isolated from patients are studied to determine their serological types. These types are identified using the hemagglutination inhibition test with a panel of specific antisera. The reaction result is indicated by the inhibition of hemagglutination.

In human pathology, influenza viruses are characterized by massive destruction of the respiratory epithelium accompanied by cell lysis. The viral hemagglutinin protein binds to host cells and disrupts their function, leading to severe systemic intoxication. This process may result in hemorrhagic damage to lung tissue and secondary bacterial pneumonia.

Parainfluenza viruses, RSV, and measles viruses share the ability to induce fusion of infected cells, forming large multinucleated structures (syncytia), which help the virus evade the immune system. Clinically, parainfluenza infection often presents with acute laryngeal edema.

COVID-19 is considered one of the most complex viral pathologies in modern medicine. These viruses bind to receptors in the lungs and cause not only respiratory distress syndrome but also damage to the vascular endothelium, leading to microthrombosis and multi-organ failure.

Conclusion:

RNA viruses—particularly orthomyxoviruses, paramyxoviruses, and coronaviruses—are among the most important causative agents of respiratory diseases in humans. Their high mutation rate, rapid transmissibility, and continuous antigenic variation make them especially significant in medical science. At the same time, these viruses can cause a wide spectrum of diseases in human pathology, ranging from mild common colds to severe pneumonia and acute respiratory syndromes.

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