Influenza

Influenza is an extremely contagious acute infectious disease caused by influenza viruses and clinically characterized by general toxic and respiratory manifestations. It is currently the only natural pandemic infection with increased mortality.

- The influenza viruses are a major determinant of morbidity and mortality caused by respiratory disease and outbreaks of infection sometimes occur in worldwide epidemics.
- The mutability and high frequency of genetic reassortment characteristic of influenza viruses and antigenic changes in the viral surface glycoproteins make influenza viruses formidable challenges for control efforts.

Etiology

- Pathogen is the influenza virus which is related to the family of ***Orthomyxoviridae,*** and contains RNA.
- Three immunologic types are known: A, B and C.
- **They are alike in their morphology**, but differ in their antigen content.
- Two antigens, hemagglutinin and neuraminidase, which creates conditions of mutation of the virus.

Etiology

- **Type A -** highly variable antigenically and responsible for most cases of epidemic influenza;
- Processes of hemaglutinin and neuraminidase changes proceed independently of each other; hemaglutinin changes occur more often.
- Appearance of the new strains of a virus leads to an epidemic.
- The new subtype of virus A causes a pandemic.

Etiology

- **Type B -** have similar types of neuraminidase and differ only in the structre of hemaglutinin, that provides more stability as compared to influenza A virus.
- **Type C -** differs in its stability of antigen structure and is a cause of sporadic diseases, especially in children.
- Influenza viruses are easily destroyed at room temperature.
- In low temperature (0...-4 °C, especially at -25...-70 °C) it maintains its infectious qualities during several years.

Epidemiology

Influenza can be **endemic**, or it can appear in **epidemics**, that occur every year or every 2 – 3 years, and **pandemics** that occur every 10 – 15 years.

Source of infection is the patients, with different forms of the disease.

- The contagious period lasts from 4 to 7 days.
- Patients with mild and abortive forms of influenza play a great epidemiological role as they can actively spread infection.

Epidemiology

- **Infection** is transmitted by the **aerial-droplet** route at relatively close distances.
- **Indirect contact** (dishes, handkerchiefs, etc.) .
- **The incidence** peaks during the winter from January through April.
- Receptivity is universal.

Epidemiology

Only children in the first months after birth are relatively resistant to influenza because of passive immunity acquired transplacentary from mothers immune to the variety concerned.

- ✓ Children are very susceptible to influenza from six months of age.
- ✓ Immunity is type and subtype specific.

Pathogenesis

Reproduction of the influenza virus in the epithelium cells of the respiratory mucosa - specific intraplasmatic inclusions containing RNA.

- The affected cells would normally degenerate and be rejected. At the same time, proliferation and metaplasia of the cylindrical epithelium occur.
- Paralytic dilation of vessels in the mucosa, small hemorrhages, edema, intensified secretion of the mucous glands are observed.

Pathogenesis

The pulmonary tissue - inflammatory process with segmental edema, focal and segmental pneumonia.

- Influenza-induced pneumonia in children with giant cells of alveolar epithelium.
- Further progress of the pathological inflammation involves secondary bacterial flora that cause viro-bacterial or bacterial pneumonia (strepto- and staphylococcal).

Pathogenesis

- Influenza is attended by pronounced circulatory disorders in various organs (lungs, brain and others parenchimatous organs), with vascular stasis, small hemorrhages dystrophic changes.
- Severe affections of the nervous system, such as encephalitis, meningoencephalitis, usually develop in the presence of mixed viral infections; the allergic mechanisms are very important in their development.

Pathogenesis

- The central place in pathogenesis of influenza is taken by circulatory disturbances associated with lesions of the vegetative innervation and vascular system.
- They play a cardinal role in causing functional derangement of the nervous system and pulmonary complications.

Influenza classification

Influenza Virus Classification

Influenza virus is classified into 3 types; A, B and C.

Type A

- Avian, human, mammalian
- Pandemics

Type B

- Human, causes epidemics disease similar to type A

Type C

- Humans, swine
- 7 segments
- lacks NA but contains esterase
- Mild infections

CLINICAL PICTURE.

The incubation period lasts 12 hours - 5 days, averaging 1-3 days.

The onset of the disease is brutal, with fever, chills, headaches, pain in the eyeballs, asthenia, arthralgia, myalgia, apathy.

In pandemics, the onset may be with the onset of toxic shock and death within 24-48 hours.

- **The illness stage** begins 6-12 hours after the onset of the disease and lasts 2-7 days and includes:
- **the toxic syndrome (algyc, nervous, febrile)**: fever (39-40^{0}C), headache, dizziness, asthenia, sleep disorders, agitation, photophobia;
- **the respiratory catarrh** occurs 1-2 days after onset, is more discreet and has symptoms of rhinitis (serous coryza then mucopurulent), pharyngitis (dysphagia, congestion, hoarseness, cough);
- **cardiovascular** manifestations: tachycardia;
- **digestive** symptoms: loss of appetite, nausea, vomiting;
- **renal** symptoms: oliguria, anuria;
- haemorrhagic syndrom: epistaxis, hemoptoic sputum, hemorrhagic rash;
- The persistent fever over 3-5 days indicates the presence of complications.

The child's facies is congested with injected conjunctiva, teary eyes and photophobia, sometimes cold sores appear.

The tonsils, the soft palate, the palatal pillars are slightly hyperemic, edematous, granular. It can also be an enanthema.

The main syndromes in influenza in children are:

- ✓ **neurotoxic,**
- ✓ **viral croup,**
- ✓ **bronchobstructive,**
- ✓ **abdominal,**
- ✓ **hemorrhagic**.
- ✓ Influenza-specific manifestation is considered **segmental pulmonary edema** that occurs as a result of circulatory disorders within a lung segment or lobe and does not manifest clinically. The diagnosis is established exclusively on the basis of radiological data - specific shadow of the respective lung segment or lobe.

- **Toxinfectious encephalopathy or neurotoxic syndrome** includes asthenia, dizziness, sleep and mental disorders, apathy, depression (in older children).

In infants with a fever of 39-40 ° C, convulsions, disturbances of consciousness, swallowing and respiratory disorders, repeated vomiting, restlessness, positive meningeal signs appear. Acute cerebral edema develops.

- **Croup syndrome** usually develops in infants and young children (up to 3 years), which is explained by the morpho-physiological features of the airways: narrow larynx, innervation and abundant vascularity, etc.. Is formed edema of the laryngeal mucosa and appear the spasm of the laryngeal muscles even in cases with mild inflammation.
- The croup may appear suddenly, usually at night.
- All the basic symptoms - hoarse voice, harsh barking cough, inspiratory dyspnea - appear at the same time against a background of high fever and pronounced signs of intoxication.
- The severity of the croup is determined by the degree of stenosis (I, II, III, IV).
- In the absence of bacterial superinfection, the evolution of the croup is benign and short-lived (1-3 days).

- **Bronchoobstructive syndrome** occurs in influenza in 4-6% of children, is manifested against a background of high fever and pronounced intoxication. Occurs: unproductive cough, expiratory dyspnea, pallor of the skin, perioral cyanosis.
- **The hemorrhagic syndrome** is usually registered in severe forms: epistaxis, bloody sputum, hemorrhagic rashes on the skin, etc.
- **Abdominal syndrome** is manifested by loss of appetite, nausea, vomiting, sometimes diarrhea, abdominal pain. Intense sabural tongue. Sometimes a pseudoapendicular syndrome also occurs.

The severity of the Influenza:

- mild;
- moderate;
- severe;
- hypertoxic (fulminating, malignant flu) – is characterised by sudden onset, fever with manifestations of acute pulmonary edema and acute respiratory failure. Extrapulmonary manifestations may also occur: myocarditis, pericarditis, hepatitis, renal impairment, meningoencephalitis, hemorrhagic syndrome .

Influenza in newborns and infants.

- The flu at this age has some peculiarities.
- The disease has a slow onset with low-grade fever, signs of influenza intoxication are absent or unpronounced.
- The skin is pale, the child refuses the chest, drowsy, decreases body mass.
- There may be mild catarrhal signs in the form of a rare cough, stuffy nose, sneezing, runny nose, repeated vomiting. Croup syndrome rarely occurs.
- Even if the initial signs of the flu are not pronounced, the evolution of the disease in children up to one year is much more severe because bacterial superinfections are common and lead to complications (otitis, pneumonia).
- Lethality is 3 times more common than in older children.

Influenza in young children (1 to 3 years)

- At this age the flu develops much more severe with pronounced intoxication, CNS disorders, the onset of neurotoxic syndrome.
- Catarrhal signs are moderate.
- Segmental pneumonia, croup, obstructive syndrome, digestive disorders are often marked.
- Complications can be purulent otitis, sinusitis, pneumonia.

Criteria of severity in influenza:

Depends on degree of the:

- neurotoxic syndrome (affecting the central nervous system);
- laryngeal stenosis;
- respiratory insufficiency;
- multisystem dysfunction.

Complications

Respiratory tract:

- ✓ **sinusitis,**
- ✓ **ethmoiditis,**
- ✓ **sphenoiditis,**
- ✓ **pneumonia**

is a common and dangerous complication that develops either during the first days of the disease or later, as the result of mixed viral and bacterial infection.

Complications

Nervous system:

- ✓ neuralgia,
- ✓ neuritis,
- ✓ radiculitis,
- ✓ encephalitis, meningoencephalitis .

- **Other complications** (stomatitis, pyelitis, cystitis, nephritis, keratitis)

- **Reye‘s Syndrom** – acute encephalopathy and fatty degeneration of the liver that affect almost exclusively the children.

Diagnosis

1. Epidemiologycal anamnesis

2. Clinical manifestations

3. Laboratory diagnosis (etiological):

- isolation of the virus (detection of influenza virus in throat swabs, nasopharyngeal washes within 3 days after onset of symptoms);
- identification of viral antigen or viral nucleic acid in patient‘s cells, or
- demonstration of a specific immunologic response.

- ✓ **Direct immunofluorescent** assay, based on detecting the antigens to influenza virus.
- ✓ **PCR -** Viral RNA may be discovered in the discharge from the respiratory tract and tissues.
- ✓ **Serologic tests** (HAIT and CFT), ELISA .

Non specific laboratory tests:

General analyses of the blood:

- ✓ leukopenia,
- ✓ lymphocytosis, monocytosis,
- ✓ eosinopenia or aneosinophilia,
- ✓ and toxic granularity of neutrophils;
- ✓ the ESR is within the normal range or little higher.

DIFFERENTIAL DIAGNOSIS: with viral respiratory infections (influenza, adenovirus, RSV infection, avian influenza (acute onset of fever with influenza-like phenomena - headache, dyspnea myalgia, tachypnea),

SARS - CoV-2002 - emerging viral respiratory disease with morbidity coronavirus, characterized clinically by: fever, chills, myalgias, dry cough, dyspnea, severe respiratory impairment, etc.),

MERS-CoV-2012 which has also been classified as a new type of zoonosis coronavirus (probably through bats and camels from Saudi Arabia and

SARS-CoV-2019.

The differential diagnosis is made with other respiratory infections: measles, mycoplasmosis, typhoid fever, pneumonia, meningococcal infection, food poisoning, sepsis.

Epidemiological data are also taken into account in the differential diagnosis.

PROGNOSIS.

- The flu usually has a favorable prognosis.
- The prognosis is reserved for young children with chronic diseases, immunocompromised.
- Severe hypertoxic forms sometimes progress to death.

Treatment

- Bed regime and nutritive diet, abundant liquids , in severe forms — infusion therapy.
- Antiviral drugs Oseltamivir, Zanamivir (neuraminidaze inhibitors).
- Symptomatic therapy.
- Antibacterial therapy is indicated in bacterial complications.

Prophylaxis

- ✓ Isolation for 7days
- ✓ Keeping to the sanitary – hygienic regimen in children's institutions.
- ✓ Inactivated influenza vaccines.
- ❖ Vaccine should be administered early in the autumn before influenza outbreaks occur and should then be given annually to maintain immunity against the most current influenza virus strains.

PROPHYLAXIS.

Outbreak contacts, especially young children, are supervised by medical workers during the maximum incubation period (5-7 days), the suspects are isolates.

- In children's communities, continuous decontamination measures are applied, repeated ventilation of the rooms (bedrooms, canteens, etc.). For prophylactic purposes, alpha-interferon (leukocyte) is used, 2-5 drops in the nose 4 times a day throughout the flu epidemic, 0.25% oxoline on the nasal mucosa.
- Children older than 7 years may receive oseltamivir 75 mg once daily for 5 days.
- Influenza prophylaxis with oseltamivir can also be performed in young children, starting at 3 months of age (3-5 months - 20 mg, 6-11 months -25 mg once a day for 5 days).

Influenza vaccination:

- It is recommended to be performed annually starting with October 15.
- Influenza vaccination is recommended for all children from 6 months of age.
- **Note:** Any flu vaccine can be given at the same time as any other vaccine given in childhood, but with different syringes and in different places or 30 days after that.