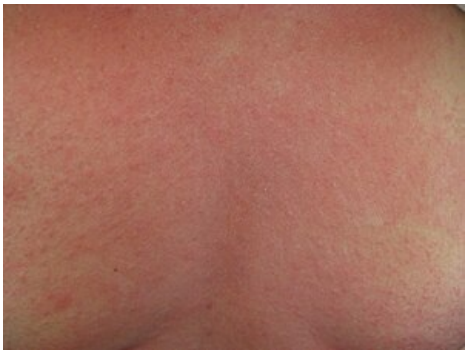
Anaphylaxis

Anaphylactic shock is a severe circulation disorder caused by immunological mechanisms. We distinguish between severe forms (anaphylactic shock - with organ systems damage and a distributional shock) and less severe forms (mild skin conditions, urticarial reaction).

> Voice changes, difficulty swallowing and dyspnoea are all signs of a severe course.

Clinical picture

The time between antigen exposure and the onset of clinical signs is usually less than one hour, the delay depends on several factors: the patient's sensitivity, the route of allergen administration and the amount of allergen. In 20% of patients, we observe a two-phase course of an anaphylactic reaction, in which the symptoms appear 6–24 hours after the initial reaction.



The skin of a patient with anaphylaxis

Skin and mucous membranes

- Pruritus and erythematous flush.
- Urticaria, which is mediated by IgE is usually located at the site of the allergen exposure, such as insect bites.
- Angiooedema (more severe cases) = swelling of the lower dermis and the subcutaneous layer.
    - Angiooedema accompanied by urticaria is itchy.
    - Non-pruritic angiooedema is not a sign of hypersensitivity (eg. hereditary angiooedema).
- Damage to mucous membranes is characterized by pruritus and congestion of the conjunctiva, nasal mucosa and oral cavity.
- Swelling of the lips or tongue can lead to difficulty swallowing, and in severe cases to respiratory distress.

Respiratory system

In the upper respiratory tract, there is life-threatening oedema of the larynx and / or the epiglottis and other adjacent structures.

- Clinically, children may report a feeling of discomfort in the throat, difficult speech, and hoarseness of voice.
- Inspiratory stridor may appear.

Lower airway involvement resembles an asthma attack with expiratory dyspnea, cough and chest retractions.

Cardiovascular system

Anaphylactic shock is a type of distributional shock. The cause of hypotension is extreme vasodilation, increased vascular permeability, and capillary leak syndrome.

> The result is an intravascular volume depletion, and a toxic effect of released mediators cannot be ruled out pathophysiologically.

Clinically, we find a patient with hypotension, difficult-to-palpate pulsations, tachycardia, but pink periphery. We can often observe arrhythmia, the ECG may show signs of myocardial ischemia.

Central nervous system

Dizziness, syncope, convulsions or alterations of consciousness may appear. Clinical signs are caused by both hypoperfusion and CNS hypoxia and the direct toxic effect of released mediators.

Gastrointestinal system

Damage includes nausea, vomiting, diarrhoea and abdominal pain. Other symptoms include rhinorrhoea, profuse sweating, metallic taste in the mouth, feeling hot, skin burning or a feeling of danger.

Severe forms

Death occurs in the first hour after the reaction!

Severe forms occur **immediately** within minutes of allergen exposure (after drug application, after insect stings).

Symptoms:

- General: nausea, chills, palmar and plantar pruritus, pallor, loss of consciousness, hypothermia, bronchospasm, laryngeal oedema, vomiting, diarrhoea;
- Breathing: rapid, shallow, wheezing;
- Cardiovascular: tachycardia, hypotension, intangible pulse, inaudible sounds, convulsions,

    ECG changes: atrial fibrillation, ST changes.

Laboratory examination:

Hemoconcentration, leucopenia, thrombocytopenia, hypoxemia, hypocapnia, later hypercapnia and acidosis with metabolic predominance also appear. Coagulation disorders in the form of DIC may occur.

Less severe forms

Less severe forms are characterized by generalized erythema and oedema, including pharyngeal oedema.
Symptoms:

- bronchospasm, irritating cough, dyspnoea.

Diagnosis

The clinical picture and the determination of the etiological agent are crucial.

We determine total and specific **IgE** and perform **skin tests** (prick tests). Elevation of **eosinophilic cationic protein** (ECP), an increase of **histamine** in both plasma and urine, and detection of **eosinophils** in bronchial or nasal secretion indicate an allergic cause. Tryptase, a specific mast cell protease, is determined experimentally.

Differential diagnosis

Vasovagal syncope is characterized by a response to pain or stress. We find cold acres, nausea, and a feeling of fainting, on the other hand, we do not see any skin marks or signs of airway obstruction. Bradycardia is typical, while anaphylaxis induces tachycardia as a compensatory mechanism. Pruritus is not present in **hereditary angiooedema**, in the family history we often find data on oedema or suffocation. We confirm the diagnosis with decreased levels of C1 complement inhibitor and decreased CH 50 complement activity. **Arrhythmia** is shown in the ECG. In patients, with **a hysterical attack,** we can sometimes also find symptoms of an anaphylactic reaction. Here, a psychiatric-psychological examination is necessary for a correct diagnosis.

Mechanism

An anaphylactic reaction is a life-threatening process in which the body reacts excessively to contact with an allergen. It is therefore a special type of allergic reaction. Contact with an allergen activates the immune system. Activation of inflammatory factors increases vascular permeability and mass transfer of intravascular fluid into the interstitium. This reduces the volume of intravascular body fluid, which leads to hypotension and the patient falls into shock.

The anaphylactic reaction is triggered by three well-known mechanisms of the immune response to foreign substance exposure.

IgE mediated reaction

It represents up to 60% of all anaphylactic reactions. IgE antibodies can be formed after a patient's first encounter with a foreign antigen. The antigen may be presented alone or in association with a protein carrier. IgE binds to mast cell and basophil receptors. Upon re-exposure to antigen → antigen leads to the bridging of IgE molecules → degranulation of these cells and release of various fast-acting mediators.

Complement mediated reaction

Immunocomplex-activated complement cascade. The result is the formation of **anaphylatoxins** such as C3a and C5a - the direct mechanism that triggers the release of mediators from basophils and mast cells. Immunocomplex activated complement is the reaction to [transfusion of blood|blood transfusion]], blood derivatives or plasma. Complement-mediated anaphylaxis occurs, for example, in patients with IgA deficiency. The formation of IgG anti-IgA antibodies has been demonstrated in these patients. The complement can also be activated directly by contrast agents and the dialysis membrane.

Direct release of mediators and other mechanisms

- The mechanism of a direct mediator release, without the involvement of IgE or complement, is still unknown. Substances capable of this reaction are, for example, hyperosmolar substances such as mannitol, radiocontrast substances, opiates, quinolones or vancomycin.
- Anaphylaxis after the administration of non-steroidal anti-inflammatory drugs (NSAID) is associated with the

blockade of prostaglandin synthesis caused by NSADs, leukotriene production increases and anaphylaxis is triggered.
- Exercise or cold-induced anaphylaxis is based on the principle of direct histaminoliberation or IgE mediated reactions.

The effect of mediators

- Release of mediators in degranulation – histamine, tryptase, heparin.
- Many mediators of anaphylaxis are formed by *de novo* synthesis – prostaglandins D2, leukotrienes, PAF, IL-4, 5, 6, 13, TNFα and adenosine.

Mediators → development of clinical signs of anaphylactic reaction: bronchospasm, increased capillary permeability, alterations of systemic and pulmonary vascular smooth muscle.

- **Histamine** causes itching, endothelial dysfunction, erythema, bronchoconstriction and fluid loss;
- **Leukotrienes** lead to endothelial dysfunction, fluid loss, bronchoconstriction or hypotension;
- **Adenosine** causes bronchoconstriction;
- **Prostaglandin D2** induces hypotension;
- **Interleukins and TNFα** cause prolonged anaphylaxis.

Treatment

Pre-medical first aid

If the patient is in shock and his upper airways are not swollen, it is advisable to place him in the Trendelenburg position. [1] Next, we perform the **correct** tilting of the head with a clearing of the airways and, if necessary, initiate cardiopulmonary resuscitation. If the allergen penetrated the tissue by injection, we cool the limb locally. Ideally, if the affected person has a package with drugs for an anaphylactic reaction, we will use them according to the instructions. [2]

Medical first aid and therapy

Respiratory protection:

Early intubation and oxygenation in airway obstruction. [1]

Circulation:

Ensuring venous access is particularly important. [1]

- rapid administration of crystalloids and volume expanders;
- administration of adrenaline to the lateral vastus muscle at a dose of 0.01 mg / kg (the maximum dose is 0.5 mg) [1]
  - Intravenous administration of adrenaline is reserved for special cases!
- Intravenous administration of antihistamines, eg Dithiaden at a dose of 1 mg IM, or preferably iv (the maximum daily dose is 8 mg). [2]
- Corticosteroids administration has a limited effect in the acute phase, so it is more suitable for the later phase. [2]
- In bronchospasm, we administer β_2-mimetics (např. Ventolin) (eg ventolin) in the usual doses as in bronchial asthma.
- For local reactions, we choose local cooling, local antihistamines, or general antihistamines p.o.

Aftercare

Patients with a history of severe anaphylactic reaction after discharge are provided with an **emergency package** in case of re-exposure to the antigen. The package should contain an ***adrenaline pen (Epipene), Prednisone tbl. and peroral antihistamines.***

The patient should be observed 12–24 hours after the response in the internal medicine or pediatric ward. [2]

References

Related articles

- Anaphylactic shock/case report

External links

- Template:Akutně
- Anafylaxe (česká wikipedie)
- ALERGIE, ANAFYLAXE, ANAFYLAKTICKÝ ŠOK (článek z časopisu Medicína pro praxi) (https://www.medicinapropraxi.cz/pdfs/med/2007/06/11.pdf)

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2. PETRŮ, Vít. *Anafylaktické reakce* [online]. Praha : ČLS JEP, 2001, Available from <http://www.cls.cz/dokumenty2/postupy/r003.rtf>.

Literature

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