Acute Phase Reactants

Template:Zkontrolováno **Acute phase reactants** is a physiological process that develops during local or systemic "inflammation", traumatic "tissue damage" (including post-surgical conditions), or "tumor growth". This reaction is less pronounced in many other situations, such as after extreme exercise, acute myocardial infarction or in the perinatal period.

Simply put, the acute phase reaction is caused by states where it occurs

- to destroy cells,
- for reversible cell damage and their subsequent repair,
- to metabolically activate some cells (especially those involved in the immune response).

In the acute phase reaction, cells actively produce and release to the environment a whole spectrum of mediators and signalling molecules that induce rapid changes in the synthesis of various proteins in the liver (and to a lesser extent in other tissues). Proteins whose plasma concentrations vary significantly (by more than 25%) are referred to as "acute phase reactants" (PAFs); , APR's). The plasma concentration of some proteins increases (so-called "positive acute phase reactants"), others decreases ("negative acute phase reactants").

Significance of acute phase positive reactants

The set of acute phase proteins is quite diverse. Nevertheless, depending on the effect, most of them can be classified into one of the following groups:

Components of the immune response

Some acute phase reactants are directly involved in the elimination of agent, which has caused inflammation. Other proteins play a role in removing damaged cells or modulating the immune response. This includes e.g.
* C-reactive protein,
* complement components, in particular C3 and C4,
* tumor necrosis factor & alpha; (TNF- & alpha;), interleukin 1 (IL-1) and interleukin 6 (IL-6).

Protection against collateral tissue damage
During the acute phase, substances are mainly released from phagocytes and crumbling cells to destroy the nox that caused the inflammation and to "dissolve" the damaged tissue. They are mainly proteolytic enzymes and reactive oxygen species. The effect of these substances should be limited so that they act only where they have to act - ie so that the so-called "collateral tissue damage" is as small as possible. Acute phase reactants therefore find

Inhibitory proteases

- α_1-antitrypsin,
- α_1-antichymotrypsin,
- α_2-makroglobulin,

Proteins that reduce the production and availability of reactive oxygen species
These are not only scavengers reactive oxygen species in the true sense of the word, but also proteins that bind and stabilize transition metals and their complexes. This reduces the formation of ROS in the Fenton reaction and similar processes. Is part of them

- haptoglobin,
- hemopexin,
- ferritin,
- ceruloplasmin.

Transport of waste products generated during inflammation
In addition to hemoglobin and hemopexin above, they probably belong here

- serum amyloid A (SAA).

Coagulation factors and proteins involved in tissue regeneration, e.g..

- fibrinogen.

The significance of some acute phase positive reactants remains "unknown", although they may be clinically important proteins (used as inflammatory parameters). For example, procalcitonin (PCT).

Rate of changes in the concentration of acute phase reactants

The plasma concentration of different acute phase reactants varies at different rates. According to the time from the beginning of the disease, during which it changes, we divide the acute phase reactants into three groups:

Early acute phase proteins

Are proteins with a very short biological half-life. Changes in their plasma concentrations are evident as early as 6-10 hours after the onset of the disease. The rise usually peaks during the second and third days. The main representatives are *'C-reactive protein (CRP)'* and *'serum amyloid A (SAA)'* . More recently, *'procalcitonin (PCT)'* has been used in clinical practice.

C-reaktive protein

__C-reaktive protein

Procalcitonin

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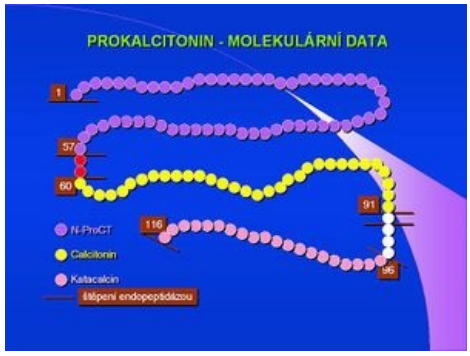

Procalcitonin - molecular data

In recent years, **procalcitonin (PCT)** has been used as an acute phase reactant in research and clinical practice. This 116 amino acid protein, with a molecular weight of 13,000, is physiologically produced by thyroid C cells as a precursor of the hormone calcitonin. However, especially in generalized bacterial infections, other cells, mainly neuroendocrine cells of the lungs and intestines, but also cells of parenchymal organs and in sepsis practically all tissues and cell types begin to produce it. The concentration of this protein in the plasma then rises sharply. PCT released during sepsis is not converted to calcitonin. The exact physiological significance of procalcitonin is far from clear; it is thought to be involved in the regulation of inflammation and to have analgesic effects. The half-life of procalcitonin is 1 day, and after immune stimulation, its serum concentration increases about twenty-fold within 2-3 hours. The increase can be observed only in **generalized bacterial, fungal and protozoal infections**, it does not occur in viral infections. Less significant increases can be found in polytraumas, burns and after extensive abdominal operations.

PCT determination

It is performed by a highly sensitive immunoluminometric method, PCT-LIA (*Luminescence ImmunoAssay*). It is a method with two monoclonal antibodies, one against the C-terminal sequence of procalcitonin (so-called catacalcin) and the other against the central part of procalcitonin (ie against calcitonin). Anti-catacalcin antibodies are immobilized on the surface of the tube, anti-calcitonin antibodies are labelled with a luminescent probe (acridine derivative). The method requires a luminometer, it requires 20 µl of serum or plasma.

As an accelerated method, an immunochromatographic test for procalcitonin (PCT-Q) in serum and plasma is used. It requires 200 µl of serum or plasma, the result is available in 30 minutes. This test is recommended for rapid diagnosis of acute pancreatitis.

PCT guide values

Normal values (ng/ml) < 0,5; chronic inflammatory processes < 0,5–1; bacterial infection complicated by systemic reaction 2–10; SIRS 5–20; severe bacterial infections – sepsis, MODS 10–1000. Elevated PCT levels persist during prolonged sepsis, while levels of some other cytokines decrease.

Non-infectious causes of increased PCT

Postoperative condition, multiple trauma, heat injury, cardiogenic shock, in newborns the first 48 hours after birth. A comparison of PCT, CRP, IL-6 and WBC shows that procalcitonin is the indicator with the highest sensitivity and specificity for the differential diagnosis of infectious and non-infectious etiology of SIRS.

References

Related articles

- Blood
- Blood plasma
- Blood draws for testing
- Blood count
- Haemocoagulation ■ Blood clotting test ■ Bleeding test ■ Erythrocyte sedimentation rate
- Biochemical blood analysis ■ Laboratory acid-base balance test
- Hemoculture ■ CRP ■ PCT

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Acute phase proteins with a mean response time

are proteins whose concentration changes 12–36 hours after the onset of the disease and the maximum is reached at the end of the first week. These include & alpha; $_1$ -acid glycoprotein (orosomucoid), & alpha; $_1$ -antitrypsin, [[haptoglobin]] and fibrinogen.

Late acute phase proteins

are represented by complement components C3 and C4 and ceruloplasmin, in which changes do not develop until 48-72 hours after the onset of the disease. The increase in concentrations is less pronounced in comparison with the two previous groups of proteins and they do not reach a peak until 6-7 days.

Negative acute phase reactants

"Negative acute phase reactants" are proteins whose levels decrease during acute exercise. The main representatives are albumin, prealbumin and transferrin. They are less important than positive reactants for monitoring and evaluating the course of the load response. However, they are often used as a criterion for protein synthesis in the liver and as indicators of malnutrition.

Odkazy

Reference

Kategorie:Vložené články Kategorie:Biochemie Kategorie:Patobiochemie Kategorie:Fyziologie Kategorie:Patofyziologie Kategorie:Patologie