Teratogens

Teratogens are generally external factors that are capable of causing the development of a congenital malformation, or significantly increase the risk of such a defect. Like mutagens, teratogens can be divided into three main groups – teratogens of biological, chemical or physical nature.

Teratogen groups

Teratogens of biological nature

In particular, these include various causative agents of infectious diseases. Proven teratogens include **viruses** (*Rubivirus* (rubella), *Cytomegalovirus*, *Herpesviruses*, *Parvovirus B-19*, influenza virus, HIV etc.), **bacteria** (*Treponema pallidum* (syphilis), but also for example **the protozoan** *Toxoplasma gondii* (toxoplasmosa).

Other maternal diseases can also be dangerous – such as diabetes mellitus, phenylketonuria, myasthenia gravis and others.

Teratogens of a chemical nature

Teratogens of a chemical nature include a number of substances used in industry or agriculture (**organic solvents**, polychlorinated biphenyls, heavy metals, etc.). An important group are **pharmaceuticals** and medicinal products. Important teratogens include**cytostatics** (e.g. no longer used Aminopterin), as well as some antibiotics (especially **tetracyclines**), **antiepileptics** (phenytoin, valproate), lithium, **warfarin**, **thalidomide**, ACE-inhibitors, substances of steroidal nature, retinoids, etc. An important teratogen is also **alcohol** (ethyl alcohol, whose abuse in pregnancy causes fetal alcohol syndrome) and some other drugs (pervitin, etc.)

Teratogens of a physical nature

This group includes mainly various types **of ionizing** radiation (X-rays, gamma-radiation, etc.), as well as high temperature and mechanical teratogens (e.g. amputation of limbs by amniotic stripes).

Specifics of the effect

The effect of teratogens is complex and certainly does not apply simplification mutagen = teratogen. Within the framework of the action of teratogens, several specifics should be taken into account:

Dose factor

The dose of the teratogenic agent is often decisive. Low doses of teratogen may not cause a birth defect at all, they may cause milder disability, or even another type of defect.

Time factor

The sensitivity to the effect of individual teratogens is not the same throughout pregnancy. In general, the worst prognosis is the action of teratogens during **the first trimester** of pregnancy, but the effect of teratogens in the second and third trimesters also has an adverse effect. Within individual teratogens, the time factor is used as a "critical period" during which the fetus is sensitive to a particular teratogen, or when an organ/system develops – the development of which is adversely affected by the effect of the teratogen. Exposure to the same dose of the same teratogen at different stages of pregnancy may have significantly different effects.

The **"All or nothing"** rule is the reaction of the early stages of the embryo ((in the period of embryogenesis) to the action of teratogens. In this period, no congenital malformations occur – the embryo can either repair all the damage ad integrum – or it disappears. In the following period – organogenesis − the action of teratogens causes developmental defects.

Genetic makeup and species factor

Sensitivity to the effects of individual teratogens is also influenced by the genetic equipment of a particular individual. Although within a single species this variability may not be significant – **interspecific variability** may be significant. This is particularly important in relation to testing the teratogenic effect of drugs and chemicals in laboratory animals, as the same dose of the same teratogen may be an important teratogen in humans, but not in the animal species used (mouse resistance to teratogenic action of thalidomide was one of the reasons for the *outbreak of the thalidomide affair*).

Links

Related Articles

- Physical and chemical teratogens
- Teratogenesis
- Drugs in pregnancy
- Infection in the neonatal period
- Fetal alcohol syndrome
- Congenital developmental defects

Source

- ŠÍPEK, Antonín. *Vrozené vývojové vady – Příčiny vrozených vad a teratogeny* [online]. ©2008-2010. [cit. 2009-08-04]. <http://www.vrozene-vady.cz/vrozene-vady/index.php?co=priciny_vad_teratogeny>.