The immune system and cancer

T-lymphocytes and **cytokines** (positive effect of IL-2, interferons, and TNFα and β) may be involved in anti-tumor immunity. In addition, **NK** and **LAK** (lymphokine-activated killer) cells are involved in the anti-tumor response. NK cells have a toxic effect on tumor cells without prior sensitization. They may be the first natural defense in the early stages of tumor growth. Tumor tissue is infiltrated by a functionally modified population of T-ly, the so-called **tumor infiltrating lymphocytes (TIL)**, which, after isolation, in vitro multiplication and infusion into the body, specifically kill tumor cells by cytotoxic effects.

The differences in the phenotype of normal and tumor cells is partly due to changes in the expression of membrane antigens and other antigens as described by *changes in the antigenic elements of tumor cells*.

Changes in antigenic elements of tumor cells

Qualitative changes

Neoantigens

The formation of **neoantigens** is conditioned by mutations in otherwise normal physiological antigens. These are recognized as **foreign** and an immune response is initiated against them and the cells that carry them. The new antigens may be specific for each type of tumor. They are then referred to as **tumor-specific transplantation antigens (TSTA)**. Transplant-type neoantigens have the ability to elicit an immune response leading to the destruction of transformed cells at the beginning of the malignant process. **Immune evasion** of transformed cells from immune control mechanisms can be caused by the natural selection in a population of tumor cells or immunosuppression in individuals. Immunological activity depends on the age and condition of the individual. Immunosuppression can also be caused by chemical, physical, and chemical factors. TSTA expression depends on the **etiology of cell transformation**: it is variable. The expression of TSTA in tumors induced by both **chemical** carcinogens and **radiation** is dependent on latency (from encounter with the carcinogen to onset of tumor growth). Tumors of **viral** etiology caused by the same virus carry the same TSTA. Such TSTAs can lead to immunization in the body. The immune system is then able to **destroy the transformed cells**. Cytotoxic T cells play a major role in this process.

> An example of the regulation of tumor growth by the immune system is Burkitt lymphoma - tumor-transformed B-lymphocytes are removed by immunological mechanisms with the crucial involvement of T-ly. On their surface, they recognize **virus-induced TSTA** presented by HLA class I molecules. In the absence or suppression of T-cells, tumor growth develops rapidly.

The immune response directed against TSTA is important in the spontaneous destruction of tumor cells at the beginning of the malignant process.

- **Prevention**: vaccination in endemic areas
- **therapy**: immunization against neoantigens

Quantitative changes

The expression of antigens that normally occur on healthy cells can be **increased** or **decreased to zero** in tumors. They may also be antigens that do not occur in healthy, fully differentiated cells. These are often antigens normally present in embryogenesis. Quantitatively altered antigen expression in tumor cells may be an important diagnostic marker. These antigenic markers are either bound to the cell surface (on MHC class I and II antigens) or are secreted into the bloodstream from tumor cells. Determination of serum **carcinoembryonic antigen (CEA) and alpha-fetoprotein (AFP)** levels is used in the diagnosis of cancer and monitoring the effectiveness of cancer treatment.

- **Elevated CEA levels** are characteristic of GIT tumors. However, it is not just a specific marker of tumor growth. Elevated levels have also been reported in other non-cancerous GIT disease processes. In normal cells, its expression is organ-limited and time-limited. In fetuses, it is found in the tissues of the intestine, pancreas, and liver. In adults, it is found in low amounts in the intestinal mucosa, lungs, and lactating mammary glands.
- **Alpha-fetoprotein** is present in the fetal liver, fetal serum, and low levels are found in the serum of healthy adults. In adults, elevated serum levels are often associated with hepatoma or testicular teratoma.

- **MHC antigens** are also used to monitor the course of certain cancers and the effectiveness of treatment. **Decreased expression of HLA class I antigens** correlates with the aggressiveness and invasiveness of gastric, ovarian, colon, kidney, breast, and pancreatic tumors. The expression of HLA class I antigens in tumor tissue is determined using *β-2-microglobulin*. **Determination of the expression** of MHC class II antigens is important for prognosis, especially in leukemia, where their absence in the leukemia cell membrane means a worse prognosis.

Other antigenic determinants used for diagnosis, prognosis, and treatment are **differentiation antigens** (membrane CD marker). They can be used to refine the diagnosis of morphologically indistinguishable cancers, especially hematological malignancies and lymphomas, and subsequently to choose appropriate treatment

procedures.

Links

References

- ŠTEFÁNEK, Jiří. *Medicína, nemoci, studium na 1. LF UK* [online]. [cit. 11. 2. 2010]. <https://www.stefajir.cz/>.

Used literature

- ŠTERZL, Ivan, et al. *Základy imunologie.* 1. vydání. Praha : Karolinum, 2005. ISBN 978-80-246-0972-0.