Tumor development

Tumor development refers to the process by which abnormal cells accumulate and grow uncontrollably, leading to the formation of a tumor mass. Tumors can be benign or malignant, and their development is influenced by various genetic and environmental factors.

Here are key points about tumor development:

Initiation: Tumor development often begins with the initiation of genetic mutations or alterations in specific cells. These mutations can occur spontaneously or be induced by exposure to carcinogens (e.g., tobacco smoke, certain chemicals, radiation).

Proliferation: Once initiated, the mutated cells may begin to proliferate and divide more rapidly than normal cells. This accelerated cell growth can lead to the formation of a mass or tumor.

Angiogenesis: As the tumor grows, it needs a blood supply to provide oxygen and nutrients. The tumor can induce angiogenesis, the formation of new blood vessels, to establish its own blood supply. Angiogenesis is regulated by various factors, including vascular endothelial growth factor (VEGF).

Invasion and Metastasis: In malignant tumors, cancer cells can acquire the ability to invade nearby tissues and spread to distant sites through metastasis. Metastasis is a complex process involving the detachment of cancer cells from the primary tumor, invasion into surrounding tissues, entry into the blood or lymphatic vessels, and establishment of secondary tumors in distant organs.

Immune Evasion: Tumor cells can evade the immune system's surveillance and recognition, allowing them to persist and grow. They can adopt various strategies to avoid immune detection or suppress immune responses, impairing the body's ability to eliminate cancer cells.

Genetic and Epigenetic Changes: Tumor development is associated with a multitude of genetic and epigenetic changes in the cancer cells. These changes can affect crucial cellular processes, including cell cycle control, DNA repair mechanisms, and cell signaling pathways, contributing to uncontrolled cell growth and survival.

Tumor Heterogeneity: Tumors are often heterogeneous, meaning they consist of a diverse population of cells with different genetic and phenotypic characteristics. This heterogeneity can contribute to treatment resistance and disease progression.

Understanding the molecular and cellular processes involved in tumor development is crucial for developing effective strategies for cancer prevention, early detection, and treatment. Advances in cancer research have led to the development of targeted therapies, immunotherapies, and precision medicine approaches that aim to specifically inhibit the growth and survival of cancer cells while minimizing harm to healthy cells.

Tumors are initiated by mutations induced by a carcinogen. Development of a tumor then requires treatment with a tumor promoter to stimulate proliferation of the mutated cells. Hormones, particularly estrogens, are important as tumor promoters in the development of some human cancers.

Serum biomarkers are defined as substances changing quantitatively in the serum during tumor development. Classically, a marker is synthesized by the tumor and released into circulation or expressed at the cell surface in large quantity by malignant cells.

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