OPEN ACCESS Freely available online

Journal of Tumor Research

ISSN: 2684-1258

Opinion Article

Tumor Suppressors: The Body's Natural Defense Against Cancer

Jaice Laura*

Department of Medical Oncology, Dana-Farber Cancer Institute, Massachusetts, USA

DESCRIPTION

In the complex environment of cellular biology, tumor suppressor genes play an important role in maintaining the integrity of our genetic makeup and preventing the uncontrolled growth of cells. While oncogenes push cells toward division and proliferation, tumor suppressors act as the brakes, ensuring that cellular processes remain in check. This article examine into the function, mechanisms and significance of tumor suppressor genes in cancer biology.

Tumor suppressor genes

Segments of Deoxyribonucleic Acid (DNA) known as tumor suppressor genes encode proteins that control cell division and proliferation. They help to repair DNA mistakes, control the cell cycle and induce apoptosis (programmed cell death) when necessary. The regulatory roles that these genes serve are lost when they are mutated or inactivated, which can result in unregulated cellular proliferation and the possible formation of malignancies.

Key tumor suppressors

Some of the most well-studied tumor suppressor genes include.

Tumor Protein 53 (TP53): TP53 is an essential enzyme that monitors cellular stress and damage to DNA. When it becomes active, it can either start apoptosis if the damage is too great to be repaired or stop the cell cycle to allow for repair. Mutations in TP53 are found in over 50% of human cancers.

Breast Cancer gene 1 *(BRCA1)* and Breast Cancer gene 2 *(BRCA2)*: These genes are involved in the processes of double-strand break repair in particular. Mutations in these genes significantly increase the risk of breast and ovarian cancers.

Phosphatase and Tensin Homolog (PTEN): This gene plays a critical role in regulating cell growth by inhibiting the PI3K/AKT signaling pathway. Loss of PTEN function is associated with various cancers, including prostate, endometrial and brain tumors.

Retinoblastoma 1 *(RB1)*: The retinoblastoma protein, encoded by the *RB1* gene, is essential for controlling the cell cycle. It prevents cells from transitioning from the G1 phase to the S phase, thereby halting unnecessary division. Mutations in *RB1* are often implicated in retinoblastoma and other malignancies.

Mechanisms of action

Tumor suppressor genes can act through several mechanisms.

Cell cycle regulation: Tumor suppressors like *RB1* help control the progression of the cell cycle, ensuring that cells do not divide uncontrollably.

DNA repair: DNA damage may be repaired more easily by genes like *BRCA1* and *BRCA2*, which stop mutations from building up.

Apoptosis induction: TP53 can trigger apoptosis in cells with irreparable DNA damage, effectively removing potentially cancerous cells from the population.

Signal transduction: Tumor suppressors often interact with various signaling pathways to inhibit pathways that promote cell survival and growth, such as the Phosphatidylinositol 3-kinase/ Protein Kinase B (PI3K/AKT) pathway regulated by PTEN.

Implications in cancer therapy

Understanding tumor suppressor genes has significant implications for cancer therapy.

Targeted therapies: Knowledge of specific mutations in tumor suppressor genes can inform targeted treatment strategies, such as Poly Adenosine Diphosphate-Ribose Polymerase (PARP) inhibitors for Breast Cancer gene (BRCA) mutated cancers.

Gene therapy: Restoring the function of mutated tumor suppressor genes through gene therapy is an area of active study, with the potential to correct the underlying genetic defects that manage cancer progression.

Personalized medicine: Genetic profiling of tumors can help to modify treatment plans based on the specific tumor suppressor gene mutations present, optimizing patient outcomes.

Correspondence to: Jaice Laura, Department of Medical Oncology, Dana-Farber Cancer Institute, Massachusetts, USA, E-mail: jaice@lau.ra.edu

Received: 29-Aug-2024, Manuscript No. JTDR-24- 34474; **Editor assigned:** 02-Sep-2024, PreQC No. JTDR-24- 34474 (PQ); **Reviewed:** 16-Sep-2024, QC No. JTDR-24- 34474; **Revised:** 23-Sep-2024, Manuscript No. JTDR-24- 34474 (R); **Published:** 30-Sep-2024, DOI: 10.35248/2684-1258.24.10.240

Citation: Laura J (2024). Tumor Suppressors: The Body's Natural Defense Against Cancer. J Tumor Res. 10:240.

CONCLUSION

Tumor suppressor genes are fundamental to our body's ability to prevent cancer. By understanding their mechanisms and roles, researchers and medical professionals can develop innovative approaches to cancer prevention and treatment. Continued analysis into tumor suppressor biological ability to uncover novel strategies for combating this complex group of diseases, ultimately improving survival rates and quality of life for cancer patients. As cancer study progresses, focusing on the preservation and restoration of tumor suppressor function will be important in combating cancer.