



Precision Oncology: Empowering Treatment Strategies with Cancer

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DESCRIPTION

The field of oncology has witnessed a paradigm shift with the advent of precision oncology, a revolutionary approach that leverages the power of cancer genomics to transform the diagnosis, treatment, and management of cancer. Traditional treatment methods often employed a one-size-fits-all approach, but precision oncology recognizes that each tumor is unique and requires personalized treatment strategies. By analyzing the genomic landscape of cancer cells, precision oncology allows healthcare professionals to customize treatment plans specifically the genetic profile of each patient's tumor. In this article, we will explore how precision oncology is empowering treatment strategies and revolutionizing cancer care.

Understanding the genomic landscape

The foundation of precision oncology lies in comprehensively understanding the genomic landscape of cancer. Genomic profiling techniques, such as Next-Generation Sequencing (NGS) enable scientists to identify genetic alterations within tumor cells. These alterations can include mutations, rearrangements, amplifications, or deletions of specific genes or regions of the genome. By decoding these genomic aberrations, oncologists gain valuable insights into the underlying drivers of tumor growth and progression.

Precision diagnostics

Precision oncology begins with accurate and comprehensive diagnostics. Genomic profiling of tumor samples allows for the identification of specific genetic alterations that can guide treatment decisions. For example, certain mutations, such as those in the Epidermal Growth Factor Receptor (EGFR) gene in lung cancer or the *BCRABL* fusion gene in chronic myeloid leukemia, have direct implications for treatment choices. Targeted therapies can be prescribed to inhibit the activity of these specific altered proteins or pathways, leading to improved outcomes and reduced side effects compared to traditional chemotherapy.

Additionally, genomic diagnostics can help identify patients who may benefit from immunotherapies. Immune checkpoint inhibitors, a type of immunotherapy, work by releasing the brakes on the immune system, allowing it to recognize and attack cancer cells. Specific genomic features, such as high tumor mutation burden or microsatellite instability, have been linked to increased responsiveness to immunotherapies. By identifying patients with these genomic characteristics, precision oncology enables the selection of the most appropriate treatment options.

Personalized treatment strategies

One of the most significant contributions of precision oncology is the development of personalized treatment strategies. By understanding the genomic alterations present in a tumor, oncologists can identify specific vulnerabilities that can be targeted with precision therapies. These targeted therapies act on the altered genes or pathways, disrupting the tumor's growth and survival mechanisms.

Kinase inhibitors, for example, are a class of targeted therapies that inhibit specific proteins involved in the growth and division of cancer cells. By targeting these proteins, the activity of the tumor can be suppressed. Furthermore, as more genomic data is gathered and analyzed, the repertoire of targeted therapies continues to expand, allowing for more tailored treatment options.

Precision oncology also encompasses the use of combination therapies to maximize treatment efficacy. By analyzing multiple genomic alterations within a tumor, oncologists can identify vulnerabilities in different pathways and employ combination therapies to attack the tumor from multiple angles. This approach increases the chances of overcoming resistance mechanisms that tumors often develop in response to single-target treatments.

Resistance monitoring and adaptive therapy

Another significant advantage of precision oncology is the ability to monitor treatment response and adapt therapy accordingly.

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Tumors are highly dynamic and can evolve over time, acquiring additional genomic alterations that render them resistant to initial therapies. By periodically re-evaluating the genomic profile of the tumor, clinicians can detect emerging resistance

mechanisms and adjust treatment strategies promptly. Liquid biopsies, a non-invasive method of genomic analysis, play a crucial role in resistance monitoring. Liquid biopsies offer a real-time snapshot of the tumor's genomic.