Precision medicine:

Next-generation diagnostics and treatments

With the increasing complexity of the cancer field, it's very difficult for oncologists who treat multiple cancers every day to keep up with the latest advances in testing and treatments

Cancer care has come a long way in a short amount of time. Major advances in precision medicine, gene-based therapy, immunotherapy, and other areas are already able to change lives today, and we plan on seeing significant progress that will impact more lives in the years ahead.[1]

HISTORICAL ONCOLOGY	PRECISION MEDICINE
Treats large groups of people with the same disease	Uses genomic testing to identify targeted therapies that may most efficaciously treat the disease
May cause more side effects to "bystander" tissues	Uses molecular data to determine specialized treatments for specific cancer cases
May lead to treatment-induced complications that could cause harm and increase costs	Reduces treatment-induced complications, along with the costs to manage them
However, historical treatments without precision medicine remain central for many patients and cancer types.	**In certain cases, precision medicine drives optimal clinical outcomes.**

DIAGNOSTICS

Liquid biopsy

"Liquid biopsies" use a blood sample to analyze tumor DNA in the bloodstream, making them much less invasive than surgical biopsies. They're even becoming more accurate at earlier stages, potentially identifying disease before it has been diagnosed based on symptoms or imaging studies. Though liquid biopsies likely won't replace the conventional method of sampling physical tumor tissue anytime soon, they're being used more to identify cancer-associated mutations when tissue isn't readily available, to detect early cancer progression or resistant disease, and to measure residual disease and recurrence.[1]

Artificial intelligence

The digital landscape is generating big data and artificial intelligence that scientists and clinicians can leverage for insights and apply to precision medicine. Through the digitization of electronic medical records, radiology, and pathology, and the synthesis of information, cancer detection and treatment optimization are more advanced than ever.

Mathematics and computational biology will progressively influence basic and translational cancer research. At the same time, mathematical modeling and machine learning will increasingly merge to produce highly sensitive and accurate testing methods for early detection.[1]

Next-generation diagnostics

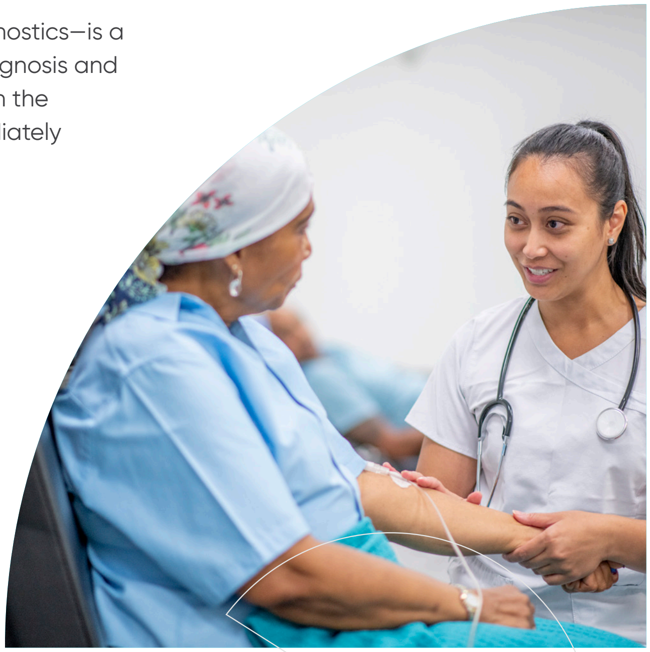
Often enabled by gene-based research, more-sophisticated diagnostic technologies are detecting cancer at an earlier stage. Advances in genomic testing over the coming years should result in more-affordable next-generation diagnostics, including blood-based tests that can measure circulating DNA, RNA, or proteins. Using these tools, physicians will be able to more quickly identify and treat cancer, potentially leading to better treatment and survival outcomes.

Next-generation imaging technology is predicted to be increasingly able to inform clinicians of the probability that an identified mass is cancerous. Emerging developments in imaging may also help predict whether specific treatments will lead to favorable responses.[2]

Theranostics

Theranostics—the combination of therapeutics and diagnostics—is a relatively new field that enables simultaneous cancer diagnosis and treatment. For example, it may use a radioactive agent in the imaging process to light up cancer cells, and then immediately deploy a second agent that attacks them.

For prostate cancer and eventually colorectal cancer, physicians will be able to utilize imaging to detect microscopic disease that routine scans would miss. Looking ahead, radioimmunotherapy is another evolving innovation that will combine theranostics agents with immunotherapy to deliver optimal, high-powered treatment to aggressive forms of cancer typically resistant to conventional therapies.[1]



CAR T-cell therapy

Chimeric antigen receptor (CAR) T-cell therapy reengineers a subgroup of white blood cells called T cells to find and destroy cancer cells. CAR T-cell therapies are currently available to treat blood cancers, and clinical trials are studying a broad array of solid tumors, with innovations evolving rapidly. For instance, efforts are underway to develop "off-the-shelf" CAR T treatments created with donor cells specifically treated to eliminate the possibility of rejection.[1]

Gene therapy

Gene-based therapy inserts a gene into a person's cells to treat cancer instead of using drugs or surgery. Gene therapies approved by the U.S. Food and Drug Administration (FDA) are available for some cancers, and researchers are innovatively pairing a tumor's genetic information with the patient's germline to further personalize treatment as well as determine the risk of developing future tumors.[1]

Monoclonal antibodies

Targeted therapies called monoclonal antibodies block a specific target on the outside of cancer cells or in the area around the cancer. They can also send toxic substances directly to cancer cells, in certain cases helping chemotherapy and radiation therapy more efficiently reach cancer cells.[3]

Molecular target inhibitors

This type of targeted treatment aims to block the growth factors allowing cancer cells to spread and multiply. Angiogenesis inhibitors, for example, keep new blood vessels that deliver nutrients to a tumor from forming in the tissue around it, thereby starving the tumor. Approved for both breast and prostate cancer, certain hormone therapies can inhibit the body from producing the hormones that hormone-sensitive tumors need to grow. Signal transduction inhibitors prevent the uncontrolled growth and division of cancer cells that leads to disease progression.[4]

For advanced lung cancer, oral targeted therapies have been approved for seven different molecular targets over the past decade. They're now a leading treatment option with far higher response rates and fewer side effects than chemotherapy-based treatment. For gastric cancer, immunotherapy in combination with chemotherapy will soon be a standard for select patients. In colorectal cancer, several ongoing trials are exploring innovative drugs to directly target KRAS, a mutation affecting up to 50% of colorectal cancer patients.[5]

For these and many other cancer types, targeted therapies are similarly being added to historical treatments or potentially replacing them.

The knowledge behind the innovation

Precision medicine provides a huge opportunity to improve the prognosis, diagnosis, and targeting of cancer therapies. Yet oncologists with the deepest expertise on the latest innovations and treatments aren't distributed geographically. People with cancer need to be able to access their knowledge and support—from wherever they live—to obtain the optimal care they deserve.

References

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