Cancer

Cancer Treatment 101

Cancer is not one but many diseases. How it is treated varies widely depending on cancer type and location, whether it has spread from its original site to other parts of the body (known as metastasis), genetic characteristics and patient preferences.

Cancer treatment has evolved rapidly in recent years, from surgery, radiation and chemotherapy to new types of targeted therapy and immunotherapy that help the immune system fight cancer.

These newer types of treatment are an example of precision or personalized medicine, tailored to individual patients. Today's targeted and immune-based therapies can be very effective, but they do not work for everyone and we don't yet fully understand how to tell in advance who will benefit.

Experimental therapies have traditionally been tested one drug at a time on one type of cancer at a time. But new therapies are increasingly being studied in combination regimens for first-line treatment rather than waiting for one drug to fail and then trying another. In addition, there is a growing trend toward treatments that work against cancer with specific genetic characteristics, regardless of where it is located in the body.

Types of Treatment

Surgery: Some localized tumors can be surgically removed, known as resection. Other tumors can be partially removed, or "debulked." In some cases, nearby lymph nodes are taken out as well. People who have surgery may also need chemotherapy or radiation therapy to kill any leftover cancer cells.

Ablation: Cancerous tumors and precancerous cells may be destroyed, or ablated, using a variety of methods including freezing, heating (hyperthermia), poisonous chemicals and lasers. Cryosurgery uses extreme cold to destroy precancerous growths and some skin cancers. Radiofrequency ablation uses heat from radio waves to destroy tumors.

Radiation therapy: Radiation may be used to shrink tumors. It works by damaging the DNA of cancer cells and stopping them from multiplying, but it can also harm healthy cells, causing side effects such as fatigue and skin problems. Radiotherapy can be administered through an external beam or internally using radioactive beads (called brachytherapy) or liquid medications (radiopharmaceuticals).

Chemotherapy: Traditional chemotherapy uses toxic drugs that kill fast-growing cancer cells. It is usually administered as pills, injections or infusions into a vein, but other methods can put the drugs closer to the cancer (for example, in the brain). In addition to cancer cells, chemotherapy also kills rapidly dividing healthy cells such as those in the gut and hair follicles, leading to side effects like nausea and hair loss.

Targeted therapy: Targeted therapies work against cancers with specific characteristics. For example, they may interfere with signaling pathways that regulate cell growth and death or prevent the formation of blood vessels needed to supply a growing tumor. During diagnosis, cancer cells may be genetically tested to see which drugs will work against them. Targeted therapies are often better tolerated than traditional chemotherapy because they are less likely to harm healthy cells, but cancer cells can become resistant to them.

Hormone or endocrine therapy: This type of targeted therapy is used to treat cancers that grow faster in the presence of sex hormones, including breast cancer and prostate cancer. Hormone-blocking drugs deprive tumors of hormones like estrogen and testosterone that stimulate their growth. But blocking hormones causes side effects: Women may have menopausal symptoms and men can develop enlarged breasts and have impaired sexual function.

Immunotherapy: Immune-based treatment helps the immune system fight cancer. For example, some tumors can turn off immune responses against them, and drugs known as checkpoint inhibitors can restore T cells' ability to recognize and destroy cancer cells. The risk with this type of treatment is that it can trigger excessive immune responses against healthy tissue as well. Current immunotherapy drugs work for only a subset of patients, and it is hard to predict who will benefit.

CAR-T: The newest type of treatment, chimeric antigen receptor T cell therapy, involves removing a sample of T cells, genetically reprogramming them in the laboratory to attack cancer cells and putting them back into the body. So far, CAR-T has been most successfully used to treat blood cancers such as leukemia and lymphoma. Here, too, there is a risk of overstimulating the immune system and causing inflammation of healthy tissue.

Transplants: Bone marrow transplants, which contain stem cells that produce all types of blood cells, are used to treat leukemia and lymphoma. A patient's cancerous blood cells are destroyed with radiation or chemotherapy and replaced with either preserved stem cells from the same individual or bone marrow from a donor. Stem cell transplants are risky: Infections may occur while the immune system regenerates itself and the transplanted donor immune cells can attack the recipient's tissues, known as graft-versus-host disease. For liver cancer, a liver transplant removes the diseased organ and replaces it with a donated liver. Transplants can potentially cure liver cancer, but donor livers are in short supply and waiting lists are long.

Treatment Response

Across all cancer types, detecting cancer earlier and starting treatment sooner leads to better outcomes. Sometimes treatment leads to a complete response or remission, meaning no remaining detectable cancer. Some cancers are considered cured if remission lasts five years or more, but there is always a risk the cancer could come back. Blood cancers and solid tumors that can be completely removed at an early stage are most likely to be cured.

Some people experience partial remission, or tumor shrinkage, which can improve symptoms and prolong survival. Treatment that aims to relieve pain and other cancer symptoms without the expectation of longer survival or a cure is known as palliative therapy.

Usually a combination of treatment types produces the best results. Often surgery is followed by radiation and medications to kill off any remaining cancer cells and keep them from growing back. A secondary therapy given after the primary treatment is known as adjuvant therapy. Sometimes medication is given before surgery to shrink tumors and make them easier to remove; this is called neoadjuvant therapy. Combinations of drugs that work differently—for example, a targeted therapy drug plus an immunotherapy drug—are often more effective than using a single medication alone.

Unfortunately, cancer doesn't always respond to treatment, which is known as being refractory. In other cases, people who initially responded to treatment have disease recurrence or relapse as the cancer starts growing again. Usually this happens because cancer cells develop drug resistance, or evolve to be able to survive in the presence of medication.

Cancer treatment has come a long way, allowing some people to be cured and many more to live longer lives with fewer debilitating side effects. But there's still a long way to go. A large number of clinical trials are underway to test many types of experimental therapy.

For more information about cancer, please visit our sister site Cancer Health.

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