



Immunotherapy's evolving role in cancer treatment

What is immunotherapy?

Immunotherapy is treatment that uses parts of a person's immune system to fight diseases such as cancer. Also called biologic therapy or biotherapy, this form of cancer treatment works by stimulating a person's own immune system to work harder or smarter to attack cancer cells or by supplementing the immune system with man-made immune system proteins.

How immunotherapy is used to prevent and treat cancer

While chemotherapy is still widely viewed as the most effective cancer fighting tool, in the last few decades, immunotherapy has become an important part of treating some types of cancer. Three main types of immunotherapy are now being used to treat cancer, including:

1 MONOCLONAL ANTIBODIES

Monoclonal antibodies are given intravenously. The antibodies themselves are proteins, so giving them can sometimes cause something like an allergic reaction.

Examples include:

- **Alemtuzumab (Campath®)** is used to treat chronic lymphocytic leukemia. It binds to cancer cells and attracts immune cells to destroy the cancer.
- **Trastuzumab (Herceptin®)** is used to fight cancers where cells have large amounts of the HER2 protein on their surface, including breast and stomach. Trastuzumab binds to

these proteins and stops them from becoming active.

- **Ibritumomab tiuxetan (Zevalin®)** is an antibody that delivers radioactivity directly to cancerous B cells and can be used to treat some types of non-Hodgkin lymphoma.
- **Brentuximab vedoti (Adcetris®)** is used to treat Hodgkin lymphoma and anaplastic large cell lymphoma that is no longer responding to other treatments.
- **Ado-trastuzumab emtansine (Kadcyla®)** is used to treat advanced breast cancer in patients whose cancer cells have too much HER2.
- **Denileukin diftitox (Ontak®)** is used to treat lymphoma of the skin and is being studied for use against a number of other cancers.

2 CANCER VACCINES

Cancer vaccines are put into the body to start an immune response against certain diseases and help prevent or treat cancer.

Prevention

Prevention vaccines target the viruses that can cause certain cancers and are **only useful for cancers known to be caused by infections**.



- **HPV** - Strains of the human papilloma virus (HPV) have been linked to cervical, anal, throat, and other cancers. Vaccines against HPV may help protect against some of these cancers when administered to boys and girls between the ages of 11 and 12.
- **HBV** - People who have chronic infections with the hepatitis B virus (HBV) are at higher risk for liver cancer. Getting the vaccine to help prevent HBV infection may therefore lower some people's risk of getting liver cancer. Children should receive vaccination series at 6 to 18 months.

Treatment

These vaccines are designed to get the immune system to attack a disease that already exists with one or more specific antigens. Because the immune system has special cells for memory, it's hoped

that the vaccine might continue to work long after it's given.

- **Sipuleucel-T (Provenge®)** is the only vaccine approved so far by the US Food and Drug Administration to treat cancer. It is used to treat advanced prostate cancer that is no longer being helped by hormone therapy.

Although the vaccine doesn't cure prostate cancer, it has been shown to help extend patient's lives by several months on average.

3 NON-SPECIFIC IMMUNOTHERAPIES

Non-specific immunotherapies boost the immune system in a general way, but they can also help the immune system attack cancer cells.

- **Interleukin-2** is a chemical made by immune cells and is approved to treat advanced kidney cancer and metastatic melanoma.
- **Interferon IFN-alfa** is another chemical made by immune cells that is approved to treat hairy cell leukemia, chronic myelogenous leukemia, follicular non-Hodgkin lymphoma, cutaneous (skin

T-cell lymphoma, kidney cancer, melanoma, and kaposi sarcoma.

- A man-made version of granulocyte-macrophage colony-stimulating factor (GM-CSF), known as **sargramostim (Leukine®)**, is often used to boost white blood cell counts after chemotherapy
- **Ipilimumab (Yervoy®)** is an antibody used to treat melanoma that can't be removed by surgery or has spread.
- **Pembrolizumab (Keytruda)** is an antibody that blocks PD-1 that has recently been approved to treat advanced melanoma.
- **Thalidomide (Thalomid®), lenalidomide (Revlimid®), and pomalidomide (Pomalyst®)** are immunomodulating drugs that boost the immune system and are used to treat multiple myeloma.
- **Bacille Calmette-Guérin** is a germ that infects human tissues and helps activate the immune system and is FDA-approved for early stage bladder cancer.
- **Imiquimod (Zyclara®)** is applied as a cream to stimulate an immune response against skin cancer cells in very early stage skin cancers.

Personalizing Cancer Treatment

Imagine a day when scientists can create a cancer vaccine designed just for you and the tumor growing in your body. Individualized cancer immunotherapy aims to produce a synthetic vaccine that is specific to the tumor and thus to the patient. That is the promise and the potential of immunotherapy.

This past spring, significant advances were made in this quest. German scientists identified genetic changes or mutations associated with various types of cancer and determined their individual blueprints. This makes it possible for scientists to readily produce customized cancer vaccines of the



kind that have already been demonstrated to be effective in animal models. Effective, individualized cancer treatment may be closer than we think.

Sources: www.cancer.org

Johannes Gutenberg Universitaet Mainz. "Significant progress made towards individualized cancer immunotherapy." ScienceDaily. ScienceDaily, 12 May 2015. <www.sciencedaily.com/releases/2015/05/150512104030.htm>.

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