

Trastuzumab

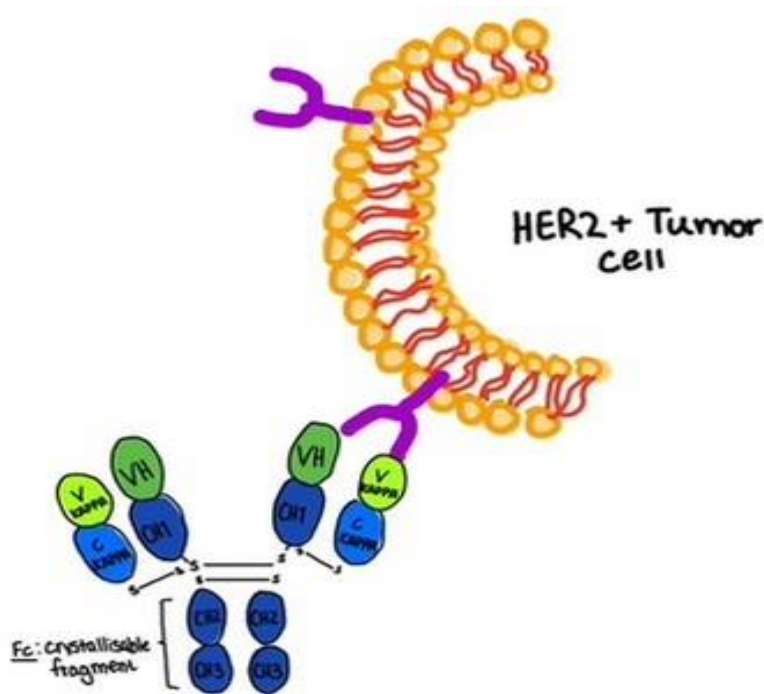
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Trastuzumab, otherwise known as Herceptin, is a monoclonal antibody primarily used to treat certain types of cancer. More specifically, the drug targets HER2-positive in breast cancer patients. In these cancers, the human epidermal growth factor receptor 2 (HER) protein is overexpressed, which promotes the growth of these highly dangerous and invasive cancer cells (1,4). However, the drug trastuzumab was developed by the company Genentech with help from scientists Axel Ullrich, Michael Shepard, and Dennis Salmon, who conducted an early clinical trial on 15 women at UCLA in 1992. Trastuzumab works its magic by binding to the HER2 receptors on the surface of these cancer cells, blocking their growth signals and marking the cells for destruction by the immune system. After extensive work in the lab and countless days of trial and error, the drug was first approved by the U.S FDA in September 1998 for breast cancer (2). Once approved, this drug was typically administered through intravenous (IV) infusion every 1 to 3 weeks. It is often used in conjunction with chemotherapy, and the duration of treatment can vary from several months to a year, depending on the severity, stage, and progression of the disease in the patient (1,3). While Trastuzumab has brought serious improvements to survival rates for patients dealing with HER2-positive cancers, it has also caused some to experience serious side effects. One of the most notable side effects is cardiotoxicity, which causes damage to the electrical and muscular components of the cardiovascular system, which in turn can lead to heart failure. Additionally, infusion-related reactions and digestive disorders can be common, and in rare cases, lung toxicity can occur. Due to these concerning side effects, patients who are taking Trastuzumab are constantly under cardiac monitoring during their treatment (1).

Trastuzumab is classified as an IgG class of antibodies, specifically IgG1, a subclass of IgG. IgG1 antibodies are most commonly used in therapeutic monoclonal antibodies due to their long half-life and effectiveness in activating phagocytes and other immune responses to help destroy

targeted cells. Also, the IgG1 antibody class is very crucial for antibody-dependent cellular cytotoxicity (ADCC), which is a key function in the drug's anticancer activity (3).

Trastuzumab Sketched Structure



Transtuzumab binds specifically to the Human Epidermal Growth Factor Receptor 2 protein (HER2). This protein is found on the surface of certain cancer cells, especially in HER2-positive breast cancer (4). HER2 is a type of receptor involved in regulating cell growth, division, and survival. By binding to the HER2 receptor, Trastuzumab blocks the proliferative signaling pathways (PI3K/AKT and MAPK pathways). These pathways are an important aspect for cancer cell survival and tumor growth (1). By binding to the HER2 receptors, trastuzumab blocks these growth signals, essentially turning off the uncontrollable cell division. In addition to blocking

these signals, the drug also activated the immune system through a mechanism called antibody-dependent cellular cytotoxicity (ADCC) (1,3). This process effectively flags the cancer cells for destruction by immune cells such as natural killer (NK) cells. Together, these actions slow down or completely stop tumor growth, reduce the size of tumors and may even in the best-case scenario, prevent the cancer from spreading through the body. For patients, this can mean longer survival, fewer cancer-related symptoms, and improved and better reaction to chemotherapy when used with other treatments (2).

Reference Page (APA)

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