answer:

HER-2 also known as ErbB2 is an oncogene located on chromosome 17. Immunohistochemical examination can be used as a complementary study for pathological diagnosis or for scientific research purposes. This process detects and analyzes tissue components (Antigen-Ag) by rebreathing specific antibodies (Ab) and the use of chromogens (chromogens). The antigen-antibody binding (Ag-Ac) shows visual markers through a microscope, and the most commonly used methods are fluorescent staining and enzymatic reactions (Enzymes are proteins that catalyze chemical reactions that occur in living beings. They accelerate the speed of reactions, which contributes to metabolism. Almost all reactions of cellular metabolism are catalyzed by enzymes). The significant advantage of this test is to understand the distribution and location of biomarkers between and in relation to the rest of the sample material. Immunohistochemical examination helps to obtain more accurate data, especially when the pathogen cannot be observed in the conventional form. The in-depth study of this tissue is usually decisive for prognostic evaluation and direction of the most appropriate treatment, being widely used in the differentiation of tumor cells in surgical pathology.

**Immunohistochemistry examination steps:**

Obtaining the biological sample; Fixation; Processing; Microtomy; Antigenic Recovery; Blockade of endogenous substances; Application of antibodies and chromogens; Histological analysis, interpretation, and diagnosis

The pre-analytical phase is related to the sample at its origin. It refers to tissue processing with the intention of ensuring the quality of the sample for examination. The analytical phase involves the selection of primary antibodies and the visualization system. Antigenic rehabilitation can be acquired by different methods and the right choice depends on factors such as: fixation time, type of fixator and the nature of the antigen and antibody. In the post-analytical phase, there is the interpretation of the results obtained immunohistochemicals for the precise clinical configuration.

FISH is a fluorescent in situ hybridization technique, so probes marking the target gene are marked with a fluorophore with a specific wavelength, and the results can only be evaluated under a fluorescence microscope with a specific filter to excite each marked wavelength. The FISH technique is done manually, and the blades have shelf life because the fluorescence will dissipate quickly.

The main indication of this test is for patients diagnosed with breast or gastric cancer and with weak HER-2/NEU immunohistochemical markers, and the results are dubious (score 2+). In this case, the fluorescence in situ hybridization method (FISH) can be used to prove or abandon gene amplification. Fluorescent in situ hybridization (FISH) is the most modern method in molecular pathology, capable of detecting genetic alterations related to cellular morphology, such as amplification, fusion, and translocation, essential for the diagnosis, prognosis, and treatment guidance of a large number of tumors. The fluorescence in situ hybridization test is a molecular pathology method, which is characterized by the identification and localization of target nucleic acid by complementary connection of probes (known DNA sequences, generally commercially available) marked with fluorescent molecules (fluorescent dyes) (DNA or RNA sequence). Using more than one fluorescent dye in the same material allows multiple identification of genetic changes by observing different colors/wavelengths of light.

The HER2 receptor is located on the membrane of epithelial cells being a protein. The acronym stands for Human Epidermal growth factor Receptor-type 2, i.e., receptor type 2 of the human epidermal growth factor. It is a protein that, in normal amounts, plays an important role in the growth and development of various epithelial cells. This subtype of breast cancer is very aggressive, so patients need to receive the most appropriate treatment to control it. The stage called metastasis is the most advanced stage of breast cancer and occurs when the tumor reaches other organs of the body besides the breast. Tumors that appear in other organs are called metastases, and breast cancer can be of different types. The presence of receptors for the female hormone’s estrogen and progesterone or her2 protein in tumor components determines the characteristics of the disease. Therefore, two women with breast cancer may have very different cancer cells from each other and therefore require specific treatments for their types of disease to obtain more effective results. In some cases, the use of specific medications can slow the growth of tumors and reduce the impact of side effects on patients, thus prolonging life.

HER2-related breast cancer is associated with a higher probability of recurrences of the disease, depending on the stage of the disease, its biological characteristics and the patient's condition (age, menopausal status, comorbidities, and preference), treatment methods may vary. Her2-positive breast cancer treatment can be divided into local surgeryand radiotherapy (inaddition to breast reconstruction); Systemic therapy: chemotherapy, hormone therapy and biological therapy. Systemic treatment will be determined based on the risk of recurrence (patient age, lymph node involvement, tumor size, degree of differentiation) and tumor characteristics that determine the most appropriate treatment.

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