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Precision Cancer Medicine and Translational Therapeutics in Treating HER-2 Positive Breast Cancer

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Key Words:
Biomarkers: These are measurable substances or molecules in the body that can indicate the presence of a disease or the effectiveness of a treatment. In this context, miRNAs and KN026 are being studied as biomarkers for breast cancer treatment.

MicroRNAs (miRNAs): These are small non-coding RNA molecules that regulate gene expression and can be used as biomarkers to predict the effectiveness of different breast cancer therapies before administering them.

KN026: This is an antibody that binds to HER2 proteins in HER2-positive breast cancer and can be used as a predictive biomarker similar to miRNAs

Neural Networks: These are computerized systems that interpret data and can be used to predict treatment responses in breast cancer patients. In this case, a neural network was used to predict responses to NAC treatments in HER2-positive breast cancer patients.

Pathological Complete Responses (pCR): This is when there are no longer signs of cancer after treatment and therapy. Predicting treatment responses beforehand, especially with the help of biomarkers and neural networks, can help achieve pCR and avoid unnecessary treatments and toxicities for breast cancer patients.

NAC stands for "neoadjuvant chemotherapy," which is a type of chemotherapy treatment given before surgery to shrink tumors and make them easier to remove.

Breast cancer is a leading cause of cancer deaths among women worldwide. Predicting how breast cancer will respond to different therapeutic treatments is critical to positive outcomes. MiRNAs and KN026 are being studied as biomarkers to predict the effectiveness of various therapies before administration. A neural network is being used to predict responses to NAC treatments in HER2-positive breast cancer patients specifically. HER2-positive breast cancer is a type of breast cancer where the cancer cells produce an excess amount of a protein called HER2. This protein can cause the cancer cells to grow and divide more rapidly than usual. HER2-positive breast cancer can be more aggressive than other types of breast cancer, but there are targeted treatments available that can help improve outcomes. This paper aims to explore the potential of using these biomarkers and neural networks to limit the unnecessary treatment of breast cancer, thereby reducing costs, overuse of resources, and overall toxicity to patients.

Introduction

Breast cancer is a complex disease, and the heterogeneity of breast cancer cells can make it challenging to find an effective treatment. The current standard of care for breast cancer treatment includes a combination of chemotherapy, radiation therapy, surgery, and hormonal therapy. However, these treatments are not without their side effects and can be costly. As such, there is a pressing need to identify more targeted and effective treatment options that can improve outcomes while minimizing toxicity and costs. The use of miRNAs, KN026, and neural networks as predictive biomarkers is a promising approach to achieve this goal. By predicting the efficacy of different therapies before their administration, we can avoid unnecessary treatments and ensure that patients receive the most effective treatments with minimal side effects.

Predictive Biomarkers:

MicroRNAs are non-coding RNA that regulate gene expression. One study suggests that miRNAs can be used as biomarkers to predict the effectiveness of different therapies before administration. Various tests can be used to identify biomarkers, depending on the specific type of biomarker being studied. For example, in the case of miRNAs, one common method for identifying them is through microarray analysis, where researchers compare the expression of miRNAs in cancerous and non-cancerous tissues to identify those that are differentially expressed. In general, the specific test used to identify a biomarker will depend on the properties of the biomarker itself and the research question being investigated. This approach can help combat excessive treatment and minimize hospital costs for both institutions and patients.

In HER2-positive breast cancer, an antibody called KN026 can bind to two epitopes of HER2 proteins. KN026 can function as a predictive biomarker similar to miRNAs. In the case of KN026, a specific antibody, tests such as ELISA or Western blotting may be used to detect its presence. One study demonstrated that KN026 was effective in assisting treatments for patients, and in combination with other therapies, it may continue to be beneficial for tracking and locating cancerous cells.

Neural Networks:

A neural network is a computerized system that interprets data. In one study, a neural network was used to predict responses to NAC treatments in HER2-positive breast cancer patients. NAC is a type of cancer treatment where patients receive chemotherapy drugs before surgical tumor extraction. Pathological complete responses (pCR) are when there are no longer signs of cancer after treatment and therapy. Heterogeneous outcomes refer to differing outcomes from the same treatments.

The study attempted to predict treatment response of HER2-positive breast cancer using AI neural networking and MRI information to predict responses to NAC treatments in hopes of achieving pCR. By predicting treatment responses beforehand, the waiting time for proper treatment caused by worrying about low effectiveness can be limited, and low efficacy side effects like toxicities can be avoided.

Discussion:

In combination, neural networking, along with miRNAs and KN026 as targeting biomarkers in the treatment of HER2-positive breast cancers, can help eliminate unnecessary treatments of these cancers, which would, in turn, reduce costs, overuse of resources, and overall toxicity to patients. With time and proper sharing of neural networking, these programs can also grow in size, efficacy, and precision over time. Predicting treatment responses beforehand in the case of breast cancer, especially with how common it is, may be vital to eliminating unnecessary treatments and toxicity.

Conclusion:

Breast cancer is a significant health concern worldwide, and predicting how cancer will respond to different therapies is critical to positive outcomes. The use of miRNAs and KN026 as biomarkers, along with neural networks, holds immense potential in limiting the unnecessary treatment of HER2-positive breast cancer, thereby reducing costs, overuse of resources, and overall toxicity to patients. Further research and development in this area can lead to more precise and effective treatment options for breast cancer patients in the future.

While newer and more advanced treatments are often more effective, they can also be more expensive, leading to disparities in access to care. One approach to minimizing costs is to optimize the use of existing treatments, such as chemotherapy, radiation therapy, and surgery. This can involve identifying patient subgroups that are most likely to benefit from a particular treatment and avoiding treatments that are unlikely to provide significant benefits.

Another area of focus for future research is the development of biomarkers to predict which patients will respond well to treatment and which patients may be at risk for developing treatment-related side effects. In the case of radiation therapy, for example, biomarkers may be used to identify patients who are more sensitive to radiation and who may require lower doses to achieve the same therapeutic effect. This approach could help to minimize radiation-related toxicity and reduce healthcare costs associated with managing these side effects. Overall, future research will likely continue to focus on improving cancer treatments to make them more effective, safer, and more accessible to patients.

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