Vaccine research shows early promise for tackling severe breast cancer

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Progress towards a unique vaccine targeting specific breast cancer antigens has been shown to delay tumor growth and prevent breast cancer metastasis in preclinical models in a study led by the Malaghan

Institute of Medical Research. The research, published in *Clinical & Translational Immunology*, shows promise for future development of an effective therapeutic vaccine against high-risk breast cancer.

In collaboration with the Ferrier Research Institute, the Malaghan Institute has been working on developing stimulatory molecules that act as "vaccine adjuvants." An adjuvant works alongside a vaccine targeting specific breast cancer markers (antigens) to boost the immune system's natural response to the cancer antigen, helping it kill all affected cells, not just at the main tumor site, but elsewhere in the body too. "We investigated our vaccines in models of both HER2-positive breast cancer and triple negative breast cancer," says Malaghan Institute Postdoctoral Fellow Dr. Olivia Burn.

"We're particularly interested in triple negative breast cancer because it can present as a more aggressive kind of breast cancer and currently has very limited treatment options."

"First-we combined segments of the HER2 protein with our immuno-stimulatory compound—a glycolipid which activates a particular immune cell population—to enhance the immune response against HER2. A single dose of this treatment delayed tumor growth and prevented its growth in the lung. Then, in a model of triple-negative breast cancer we used a different vaccine that targeted parts of the protein NY-ESO-1, which is often overexpressed in these cancers, particularly when it has spread to other organs and found similarly encouraging anti-tumor results."

Breast cancer is one of the most common forms of cancer. Around 1 in 9 Kiwi women are affected by breast cancer in their lifetime, according to the Breast Cancer Foundation, and while the survival rate is high thanks to early detection measures such as screening, more than 650 women in New Zealand die from breast cancer every year.

"While breast cancer is very treatable, the principal cause of breast cancer mortality is not the initial tumor itself, but its spread to other parts of the body. Preventing this spread, or metastasis, is key to reducing the number of people who die from this disease," says Dr. Burn.

"Metastatic cancers typically originate from a single source, with the resulting tumors often being copies of the 'parent' tumor and displaying the same physical markers on their surface. Because of this similarity, there is good potential for developing a breast cancer vaccine that prevents the tumor from spreading to other parts of the body." Dr. Burn says this research indicates that this unique glycolipid-vaccine platform can be used to generate strong immune responses against clinically relevant breast cancer markers.

"Future steps could include progressing this vaccine design, possibly using RNA technology, where the whole protein for HER2 and NY-ESO-1 could be used as a vaccine target, which would provide greater population coverage. RNA technology could also make it easier to investigate other relevant breast cancer markers and help us assess if metastasis to other organs, such as the liver, can be prevented."

More information: Olivia K Burn et al, Glycolipid-peptide conjugate vaccines elicit CD8 + T-cell responses and prevent breast cancer metastasis, *Clinical & Translational Immunology* (2022). DOI: 10.1002/cti2.1401

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