Public/Lay Abstract

Triple-negative breast cancer (TNBC) is an aggressive form of breast cancer that often spreads to the brain, a condition known as brain metastasis. This is particularly challenging to treat because current therapies have limited effectiveness, partly due to the blood-brain barrier that protects the brain but also blocks many drugs. Brain metastases occur in up to 40% of TNBC patients and significantly worsen their prognosis.

Our research aims to develop a novel treatment for TNBC brain metastases using tiny particles called extracellular vesicles. These vesicles come from special immune cells called dendritic cells, which we modify to make them more effective at stimulating the immune system against cancer. We load these vesicles with a protein called alpha-lactalbumin, which is found in many TNBC tumors, and engineer them to boost the immune response against the cancer.

Our goal is to create specialized particles called dendritic cell-derived extracellular vesicles, which we load with proteins found in TNBC tumors. These vesicles are designed to be delivered as a nasal spray. When sprayed into the nose, these vesicles can reach the brain, bypassing the blood-brain barrier. Once in the brain, they're designed to activate the immune system to fight against the cancer cells that have spread there.

We will test this approach in laboratory models of TNBC brain metastases to see if it can slow down or stop the growth of these tumors and improve survival. We'll also combine our treatment with existing immunotherapies to see if we can make them work better for brain metastases.

If successful, this research could lead to a new, non-invasive treatment option for patients with TNBC brain metastases. This could potentially improve survival and quality of life for these patients, who currently have very limited treatment options. While our immediate focus is on TNBC, this approach could potentially be adapted for other subtypes of breast cancers that spread to the brain in the future.

This work is significant for patients with metastatic breast cancer because it addresses a critical unmet need in treating brain metastases, which are often the most life-threatening aspect of advanced breast cancer. By harnessing the power of the immune system and overcoming the blood-brain barrier, we hope to offer new hope for patients facing this difficult diagnosis.