Nanoparticle RNA Vaccine That Targets Slow-Cycling, Treatment-Resistant Cancer

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Technology description

Activates T-Cell Recognition of Tumor-Initiating Stem Cells in Mouse Model of Glioma

This nanoparticle vaccine targets the slow-cycling, treatment-resistant, cancer stem cells to improve efficiency of anti-cancer drugs, thereby improving disease prognosis. Despite major developments in the field of anti-cancer therapies, tumor recurrence and metastasis after chemotherapy is still the major cause of cancer patient mortality. Although current RNA-lipid nanoparticle (NP) vaccines have shown promising results, they still remain encumbered by profound intra-tumoral and systemic immunosuppression. Because of the heterogeneity of cancer epitopes, a major challenge in the field of vaccine development is determining the best target. Studies carried out by our researchers at the University of Florida have demonstrated that recurrences in gliomas can be attributed to the subset of slowly dividing cells, resistant to conventional anti-cancer therapies. These slowly dividing cells exhibit enhanced tumorigenicity and infiltrative propensity. Hence, clinical strategies targeting this specific population of cancer cells holds great potential in improving therapeutic efficiency of drugs.
To address this issue of cancer recurrence, our scientists have developed a universal RNA-NP vaccine engineered with RNAs for epitopes specific to slow-cycling tumor cells, as well as a personalized RNA-NP vaccine engineered from RNA extracted from patient’ s tumor biopsy. These vaccines are able to activate T-cell recognition of slow-cycling tumor-initiating stem cells mediating sustained anti-tumor activity in the mouse model of glioma.
Technology
This therapeutic platform demonstrates the use of two different nanoparticle (NP) vaccines (personalized and universal) engineered with RNA derived from a specific subpopulation of slow-cycling, tumor-initiating stem cells. These immunomodulating vaccines are able to elicit T-cell response against slow-cycling, tumor-initiating cancer stem cells, leading to sustained anti-tumor activity. Researchers found that systemic administration of this vaccine primes the peripheral and intra-tumoral microenvironments for response to immunotherapy. These RNA-NPs localize to heart, lung, bone marrow, spleen, liver, kidney and subcutaneous/intracranial tumors. In immunologically resistant tumor models (i.e. B16F0, B16-F10, Lewis lung carcinoma) resistant to immune checkpoint inhibitors, these RNA-NPs activate the preponderance of systemic and intra-tumoral antigen presenting cells (characterized by co-expression of PD-L1 and CD86) for induction of anti-tumor immunity. Altogether,

this therapeutic platform delivers specific sets of tumor RNA antigens purified from slow-cycling cancer stem cells to create personalized or universal vaccines.

Application area

Nanoparticle vaccine for either personalized or universal treatment of cancer

Advantages

Can be engineered using relevant tumor antigens, creating a universal RNA-NP vaccine to target treatment-resistant, slow-cycling cancer cells
Can be engineered with RNA extracted from patient’ s tumor biopsy, creating personalized RNA-NP vaccines
Increased efficacy and specificity, generating robust and expeditious anti-tumor response
Overcomes intra-tumoral and systemic immunosuppression, priming the system to respond better to immunotherapy

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