Chitosan coated, chemotherapy packed nanoparticles may target cancer stem cells

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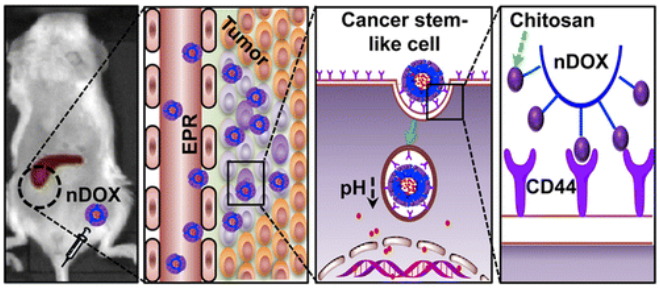

Nanoparticles packed with a clinically used chemotherapy drug and coated with an oligosaccharide derived from the carapace of crustaceans might effectively target and kill cancer stem-like cells, according to a recent study led by researchers at The Ohio State University Comprehensive Cancer Center - Arthur G. James Cancer Hospital and Richard J. Solove Research Institute (OSUCCC - James).

Cancer stem-like cells have characteristics of stem cells and are present in very low numbers in tumors. They are highly resistant to chemotherapy and radiation and are believed to play an important role in tumor recurrence. This laboratory and animal study showed that nanoparticles coated with the oligosaccharide called chitosan and encapsulating the chemotherapy drug doxorubicin can target and kill cancer stem-like cells six times more effectively than free doxorubicin.

The study is reported in the journal *ACS Nano*.

"Our findings indicate that this nanoparticle delivery system increases the cytotoxicity of doxorubicin with no evidence of systemic toxic side effects in our animal model," says principal investigator Xiaoming (Shawn) He, PhD, associate professor of Biomedical Engineering and a member of the OSUCCC - James Translational Therapeutics Program.

"We believe that chitosan-decorated nanoparticles could also encapsulate other types of chemotherapy and be used to treat many types of cancer."

This study showed that chitosan binds with a receptor on cancer stem-like cells called CD44, enabling the nanoparticles to target the malignant stem-like cells in a tumor.

The nanoparticles were engineered to shrink, break open, and release the anticancer drug under the acidic conditions of the tumor microenvironment and in tumor-cell endosomes and lysosomes, which cells use to digest nutrients acquired from their microenvironment.

He and his colleagues conducted the study using models called 3D mammary tumor spheroids (i.e., mammospheres) and an animal model of human breast cancer.

The study also found that although the drug-carrying nanoparticles could bind to the variant CD44 receptors on cancerous mammosphere cells, they did not bind well to the CD44 receptors that were overexpressed on noncancerous stem cells.

More information: Chitosan-Decorated Doxorubicin-Encapsulated Nanoparticle Targets and Eliminates Tumor Reinitiating Cancer Stem-like Cells, *ACS Nano*, 2015, 9 (6), pp 5725–5740. DOI: 10.1021/nn506928p

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