

Holey Nanoparticles Create New Tumor Imaging and Therapeutic Agent

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Using a polymer that has both water-soluble and water-insoluble regions, a team of investigators from the Siteman Center of Cancer Nanotechnology Excellence has created a nanoparticle shaped like a bialy, a close relative of the bagel.

Combining this nanoparticle with manganese, a metal that boosts magnetic resonance imaging signals, and an antibody that targets blood vessels, the investigators then created a new type of imaging agent that also has the potential to deliver drugs to tumors.

Gregory Lanza, M.D., and Samuel Wickline, M.D., both at Washington University of St. Louis, led the research team that set out to create a magnetic resonance imaging (MRI) contrast agent based on manganese rather than gadolinium, which is widely used today in a variety of medical imaging applications. Recent reports showing that gadolinium-based contrast agents can produce irreversible kidney damage in some patients have prompted the imaging community to search for equally effective but safer contrast agents. Manganese may fit this bill, but only with a means of delivering it to targeted tissues.

Nanobialys that self-assemble from the polymer poly(ethyleneimine) appear to have promise as such a delivery agent. The bialy shape, also known as a torus, has a large surface area exposed to water, a key for manganese to function as an effective MRI contrast agent. When the bialys form in the presence of manganese, the metal becomes incorporated stably in the nanostructure. Once formed, the investigators

were able to add vascular targeting molecules using a mild chemical coupling reaction to the nanobialy polymer.

Using a targeting agent that binds to fibrin, a major component of clots that form in blood vessels, the investigators were able to image clots using MRI in an in vitro assay system. The investigators were also able to load the nanobialys with two different anticancer agents—doxorubicin, which is water soluble, and camptothecin, which is water insoluble. The researchers plan further tests with these drug-loaded, targeted nanobialys.

This work, which was supported in part by the National Cancer Institute's Alliance for Nanotechnology in Cancer, is detailed in the paper "Ligand-Directed Nanobialys as Theranostic Agent for Drug Delivery and Manganese-Based Magnetic Resonance Imaging of Vascular Targets." Investigators from Philips HealthCare and St. Thomas's Hospital in London also participated in this study.

Source: National Cancer Institute

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