Nano World: Nano-drugs cure mouse prostate

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A single injection of nanoparticles loaded with drugs completely eliminated prostate tumors in mice, experts told UPI's Nano World.

Annually some 230,000 people get prostate cancer, killing 30,000 a year, explained researcher Omid Farokhzad, a molecular biologist and anesthesiologist at Brigham and Women's Hospital in Boston. The current state-of-the-art therapies for prostate cancer either implant radioactive material in the cancer to kill off cells or remove the entire diseased prostate gland. The radioactive therapy can prove effective but can lead to erectile dysfunction, urinary retention and radiation-induced bowel injury.

"A non-radioactive system such as our system could prove more efficient and less toxic than the current state of the art therapies, and much less toxic than traditional drugs, which can lead to many chemotherapy-associated complications," Farokhzad said.

The nanoparticles consisted of the anticancer drug docetaxel encapsulated within a safe, biodegradable polymer, to release the drug continually over time after the tumor absorbs the nanoparticles. The polymer is also effective against immediate removal from the body by the immune system, to help ensure the nanoparticles reached their intended target and do not inadvertently get absorbed by other cells beforehand.

The nanoparticles in turn were coated with RNA sequences known as

aptamers, which can bind to specific cell surface receptors. In this case, the sequences targeted the prostate specific membrane antigen, a molecule that populate the surfaces of prostate cancer cells that is well known to get absorbed into the cell interior as well.

In mice, a single injection of the nanoparticles directly into prostate tumors resulted in complete tumor reduction in five of seven mice, with 100 percent surviving the entire 109-day study period. In contrast, nanoparticles without the RNA sequences resulted in complete tumor reduction in only two of seven mice and saw a 57 percent survival rate, while docetaxel treatment alone only had 14 percent survivability.

The Food and Drug Administration had approved the drug and polymers used in the nanoparticle therapy for prior clinical use, and the RNA aptamers are easy to synthesize and are not known to trigger immune responses, factors which the researchers hope could help quickly bring their nanoparticles for treatment in people.

"The route to FDA approval is a little easier if a new device or drug is based on materials that are already in use for other applications," said mechanical engineer David LaVan at Yale University in New Haven, Conn. "This does not mean that they can be used automatically, just that the approval path is shorter. It is good to see, as it is common for people to develop new materials like this with little awareness of what has been approved or not in the past."

Researcher Robert Langer, a chemical engineer chemical engineer at the Massachusetts Institute of Technology, added, "this technology could be applied to almost any disease" by re-engineering the nanoparticles' properties to make them target other cells and diseases. "The work could have widespread applications beyond prostate cancer through the use of specific aptamer-antigen combinations for other types of cancer," said biomedical engineer Jason Burdick University of Pennsylvania in

Philadelphia.

Langer, Farokhzad and their colleagues reported their findings online Monday via the Proceedings of the National Academy of Sciences.