Nanotube therapy takes aim at breast cancer stem cells

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Wake Forest Baptist Medical Center researchers have again proven that injecting multiwalled carbon nanotubes (MWCNTs) into tumors and heating them with a quick, 30-second laser treatment can kill them.

The results of the first effort involving kidney tumors was published in 2009, but now they've taken the science and directed it at breast cancer tumors, specifically the tumor initiating cancer stem cells. These stem cells are hard to kill because they don't divide very often and many anti-cancer strategies are directed at killing the cells that divide frequently.

The Wake Forest Baptist research findings are reported online ahead of April print publication in the journal *Biomaterials*. The research is a result of a collaborative effort between Wake Forest School of Medicine, the Wake Forest University Center for Nanotechnology and Molecular Materials, and Rice University. Lead investigator and professor of biochemistry Suzy V. Torti, Ph.D., of Wake Forest Baptist, said the breast cancer stem cells tend to be resistant to drugs and radiotherapy, so targeting these particular cells is of great interest in the scientific community.

"They are tough. These are cells that don't divide very often. They just sort of sit there, but when they receive some sort of trigger – and that's not really well understood – it's believed they can migrate to other sites and start a metastasis somewhere else," Torti explained. "Heat-based cancer treatments represent a promising approach for the clinical management of cancers, including breast cancer."

Using a mouse model, the researchers injected tumors containing breast cancer stem cells with nanotubes, which are very small tubes made of carbon. By themselves, said Torti, nanotubes don't have any anti-tumor properties, but if they are exposed to laser-generated, near-infrared radiation they start to vibrate and produce heat. This combination can produce a local region in the tumor that is very hot, she said. Using this method, the group was able to stop the growth of tumors that were largely composed of breast cancer stem cells. This suggests that nanotube-mediated thermal treatment can eliminate both the differentiated cells that constitute the bulk of the tumor and the cancer stem cells that drive tumor growth and recurrence.

"To truly cure a cancer, you have to get rid of the entire tumor, including the small population of cancer stem cells that could give rise to metastasis," Torti said. "There's more research to be done. We're looking at five to 10 years of more study and development. But what this study shows is that all that effort may be worth it – it gives us a direction to go for a cure."

Provided by Wake Forest Baptist Medical Center

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