Gold nanorods could improve radiation therapy of head and neck cancer

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Radiation therapy is an important part of head and neck cancer therapy, but most head and neck tumors have a built-in mechanism that makes them resistant to radiation. As a result, oncologists have to deliver huge doses of X-rays to the patient, damaging surrounding tissues and producing significant side effects. To overcome this resistance, researchers at the State University of New York (SUNY) at Buffalo and the University of Southern California (USC) have developed a nanoparticle formulation that interferes with the resistance mechanism, and as a result, increases the efficacy of radiation therapy in a mouse model of head and neck cancer.

Reporting its work in the journal Integrative Biology, a research team headed by Paras Prasad of SUNY Buffalo and Rizwan Masood of USC's Keck School of Medicine describes how it used gold nanorods to deliver a small interfering RNA (siRNA) molecule to head and neck tumors. This siRNA molecule blocks the production of a protein known as sphingosine kinase 1 (SphK1). Previous work by the USC team had shown that this protein prevents radiation-damaged cells from undergoing apoptosis, the cell death program triggered in healthy cells when they age or experience major damage.

RNA interference, which uses siRNAs to reduce the production of specific proteins, has shown promise for treating cancer and other diseases, but these molecules are readily degraded in the blood stream. To overcome this problem, the SUNY-Buffalo team, an early pioneer in the cancer nanotechnology field and an original member of the National

Cancer Institute's Alliance for Nanotechnology in Cancer, has developed biocompatible gold nanorods that can protect siRNAs from degradation and deliver them to tumors.

Working together, the two groups created a gold nanorod-siRNA construct that targets SphK1. When injected directly into head and neck tumors growing in mice prior to radiation therapy, this formulation boosted the efficacy of radiation therapy by over 50 percent. Moreover, this boost in efficacy was seen using greatly reduced doses of radiation. Animals that were treated with the nanoparticle formulation showed no ill effects from the drug. The investigators are now developing a new formulation that could be used to sensitize tumors for which direct injection of drug is not feasible.

This work, which was supported in part by the National Cancer Institute, is detailed in a paper titled, "Gold nanorod–sphingosine kinase siRNA nanocomplexes: A novel therapeutic tool for potent radiosensitization of head and neck cancer." An abstract of this paper is available at the journal's website.

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