Nanoparticles Improve Ultrasound Sensitivity for Cancer Detection

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Targeted nanoparticles may eventually help physicians detect the very earliest stages of cancer using readily available ultrasound equipment, a new study from investigators at The Ohio State University suggests. The results of this study, published in the journal *Physics in Medicine and Biology*, show that silica nanoparticles have a marked effect on boosting reflection of ultrasonic energy as it passes through the body.

In laboratory experiments on mice, scientists found that silica nanoparticles injected into the animals improved the resulting images. This study is one of the first reports showing that ultrasound can detect these tiny particles when they are inside the body, said Thomas Rosol, D.V.M., Ph.D., who along with Jun Liu, Ph.D., led the research team.

“Given their tiny size, nobody thought it would be possible for ultrasound to detect nanoparticles,” he said.

It turns out that not only can ultrasound waves sense nanoparticles, but the particles can brighten the resulting image. One day, those bright spots may indicate that a few cells in the area may be on the verge of mutating and growing out of control.

“The long-term goal is to use this technology to improve our ability to identify very early cancers and other diseases,” said Liu. “We ultimately want to identify disease at its cellular level, at its very earliest stage.”

Rosol said that Liu and her team are working on creating biodegradable

nanoparticles. For the purposes of this study, however, the researchers wanted to use a hard substance, silica, to see if their idea would work. The strongest ultrasound signals are those produced when sound waves bounce off a hard surface. While not biodegradable, the nanoparticles used in the study were biologically inert.

The researchers took ultrasound images of the animals' livers every five minutes for 90 minutes after the injection. The nanoparticles had accumulated in the animals' livers. Another future step for this work is to label nanoparticles tumor-targeting molecules.

“The liver takes up foreign substances in the body, so it's not surprising that that's where we saw the particles,” Rosol said. “But we ultimately want to be able to make these particles go to the mammary glands or other tissues we're interested in.”

The ultrasound images grew brighter over the 90-minute period. The researchers compared these images to those from a group of control mice injected with a saline solution. There was no change in ultrasound image brightness in the control mice after that injection.

This work, which was supported in part by the National Cancer Institute, is detailed in a paper titled, “Nanoparticles as image enhancing agents for ultrasonography.” An abstract of this paper is available through PubMed.

Source: National Cancer Institute