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Going for gold with a novel interventional radiology treatment for pancreatic cancer

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Pancreatic cancer—known as the most fatal cancer with no known effective treatment—requires a radical new therapy. A promising approach may come in the form of tiny gold nanoparticles—loaded with a therapeutic agent to kill cancer—in a novel procedure called "nanoembolization," said researchers at the Society of Interventional Radiology's 35th Annual Scientific Meeting in Tampa, Fla.

"As current treatments for pancreatic cancer offer minimal benefit, entirely new approaches are needed. We've developed a radically different approach that might be able to overcome some of the obstacles that have hampered previous therapies for pancreatic cancer," said Reed A. Omary, M.D., M.S., an interventional radiologist and professor of radiology and biomedical engineering and vice chair of research in the radiology department at Northwestern University in Chicago, Ill. Traditional attempts to treat this particularly horrible cancer include some combination of chemotherapy, radiation therapy, and/or surgery. However, none of these methods results in effective treatment.

Instead, Northwestern researchers constructed extremely tiny particles made out of gold—termed nanoparticles—with cancer-killing agents attached to them. These nanoparticles, which measure only 13 nanometers in diameter, are so small that 8,000 of them could be strung together and still occupy less than the width of a single human hair. In animal studies, the research team used an interventional radiology technique to inject the cancer-killing nanoparticles directly into the tumor. The investigators call this novel delivery technique

"nanoembolization." Omary said, "Using nanoembolization, we dramatically increased the concentration of the nanoparticles in the tumor by 55 times over traditional methods that use a vein (such as at the elbow). That's a massive improvement—and a promising discovery for this dreadful disease."

The pancreas is the organ located behind the stomach. It produces juices that help break down food and hormones that help control blood sugar levels. Pancreatic ductal adenocarcinoma is the most common type of pancreatic cancer and carries the worst prognosis of any cancer, even when diagnosed early. This aggressive cancer typically has a six-month survival rate at diagnosis. In 2009, it was estimated that more than 42,000 individuals, typically over the age of 60, were diagnosed with pancreatic cancer, making it the fourth-leading cause of cancer death in the United States. Because it is often found late and it spreads quickly, pancreatic cancer can be hard to treat.

"As current treatments offer minimal benefit, entirely new approaches are needed," said Omary, in explaining the pre-clinical study. A major reason that current pancreatic cancer treatments do not work is that scar tissue develops around the cancer. This scar tissue blocks cancer-killing drugs from entering the tumor in the first place, said Omary. "We used a catheter to deliver cancer-killing nanoparticles directly to the tumor. The catheter is placed into an artery near the groin and navigated through blood vessels to the site of the tumor, all without surgery. Once in the blood vessel that supplies the tumor, the catheter can deliver nanoparticles directly into the tumor. This method may offer a better way to overcome the scar tissue that blocks drugs from attacking the tumor," he added. With this type of catheter delivery, more drug "can go directly where we want it: to the tumor itself," said Omary. "This is not the case with injections through a vein, where the cancer-killing drug may not end up where it needs to be," he explained. The direct catheter injections also have the potential to reduce some of the side effects such

as vomiting and hair loss that may be seen with typical chemotherapy. "Researchers have been using the same tool box for a long time without any benefit; it's time for us to apply some high-tech tools to treat pancreatic cancer," said Omary, the senior author of "Image-guided Nanoembolization as a Novel Local Therapy for Pancreatic Cancer: Feasibility in an Animal Model."

"For decades, interventional radiology has offered innovative ways to treat cancer patients instead of traditional surgery, chemotherapy or radiation; after all, we invented the field of minimally invasive medicine. Interventional radiologists recognize that the greatest advances in medicine occur at the interface with other medical disciplines," said Omary. "Nanoembolization is a terrific example of bringing together a diverse range of experts—in interventional radiology, chemistry and oncology—to develop a radically different method to treat the cancer with the most dismal survival rate," he added. Omary praised the efforts of all the Northwestern investigators including nanomedicine experts Chad A. Mirkin, Ph.D., director of the university's International Institute for Nanotechnology and a member of President Obama's Council of Advisors for Science and Technology, and C. Shad Thaxton, M.D., Ph.D., assistant professor of urology. Omary emphasizes that before this proposed new treatment is ready for patients, more studies will be needed to show safety and effectiveness.

Provided by Society of Interventional Radiology