Using Particles That Are Smaller Than the Head of a Pin to Treat Cancer

2022-07-20
Patients with high-grade ovarian cancer and uterine serous cancer (USC) often respond well to surgery and chemotherapy. At first.

But these can be highly aggressive tumors that often spread into the space within the abdomen known as the peritoneal cavity. According to a recent study, one rare but aggressive type of uterine cancer is propelling an increase in deaths from the disease in the United States, particularly among Black women.

Moreover, resistance to chemotherapy often develops, and the disease recurs. This results in ovarian cancer causing more deaths than any other cancer of the female reproductive system.

For one possible treatment, clinical trials demonstrated the effectiveness of injecting a drug known as epothilone B (EB) into the abdominal cavity, targeting tumor cells that have grown resistant to standard chemotherapy medications. However, the drug's high toxicity when delivered this way causes severe side effects, preventing further use.

Now, thanks in part to research begun more than a decade ago with funding from Women's Health Research at Yale, our colleagues are closing in on a way to deploy effective cancer-fighting medication safely with the help of ultra-tiny non-toxic biodegradable objects known as nanoparticles. Developed by Dr. W. Mark Saltzman, the Goizueta Foundation Professor of Biomedical and Chemical Engineering, these nanoparticles have organic chemicals on their surface that allow them to stick to cells in the abdominal cavity so they are not cleared from the area before they can do their job.

“With bioadhesive nanoparticles, we can safely entrap a drug and deliver it so it slowly releases in a high concentration, directly to our target, over a long time,” Saltzman said. “By localizing the delivery of the drug, we are decreasing toxicity and increasing effectiveness.”

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With data funded through WHRY’s grant, Drs. Saltzman and Alessandro Santin, professor of obstetrics, gynecology, and reproductive sciences, secured funding from the National Institutes of Health to demonstrate the safety and efficacy of this technique in a model system, publishing their results in 2016.

Saltzman then partnered with Dr. Michael Girardi, Evans Professor of Dermatology, to develop a non-surgical treatment for skin cancer using injections of nanoparticles carrying a chemotherapy agent. In a paper published last year, they demonstrated the capacity for this method to bind to the tumors and kill a significant number of cancer cells. In addition, the treatment involves triggering an immune response to rid the body of cancer cell waste and respond against any remaining cancer cells.

Drs. Saltzman and Girardi founded a company called Stradefy Biosciences, which has licensed patents to this technology from Yale, while continuing to develop these techniques for clinical use.Dr. Nita Ahuja, William H. Carmalt Professor of Surgery and chair of surgery, serves as an advisor for abdominal cancer applications.

“We are thrilled that the work we sponsored many years ago continues to produce such varied applications for serious health concerns,” said WHRY Director Carolyn M. Mazure, PhD. “This is the model for how investing in Yale’s most innovative and collaborative individuals can produce steady progress that will improve and even save lives.”

Dr. Saltzman also used a WHRY grant to create a vaginal ring that provides contraception

while protecting against sexually transmitted infections. Yale has filed a patent application on this unique ring design, and Saltzman continues to seek funding to further develop the product and possibly adapt it to treat endometriosis.

“The type of funding WHRY provides is critical for the innovation-based work I do,” Saltzman said. “I could say, ‘We are going to make these particles with this unique property.’ But to get substantial buy-in from a company or the NIH, you need to have the data to demonstrate that this works. Early funding, particularly for collaborative projects with unproven technologies, is critical.”

Read the original article on Yale University.