Implantable Device Offers Continuous Cancer Monitoring

July 21 2009

(PhysOrg.com) -- Surgical removal of a tissue sample is now the standard for diagnosing cancer. Such procedures, known as biopsies, are accurate but offer only a snapshot of the tumor at a single moment in time.

Monitoring a tumor for weeks or months after the biopsy and tracking its growth and how it responds to treatment would be much more valuable, says Michael J. Cima, Ph.D., who has developed the first implantable device that can do just that. Dr. Cima, professor of materials science and engineering at the Massachusetts Institute of Technology (MIT) and a member of the MIT-Harvard Center of Cancer Nanotechnology Excellence (CCNE), and his colleagues reported in the journal *Biosensors and Bioelectronics* that their device successfully tracked a tumor marker in mice for 1 month. Fellow MIT CCNE investigators Robert Langer, Ph.D., Al Charest, Ph.D., M.Sc., and Ralph Weissleder, M.D., Ph.D., also contributed to this work.

Such implants could one day provide up-to-the-minute information about what a tumor is doing—whether it is growing or shrinking, how it is responding to treatment, and whether it has metastasized or is about to do so. “What this does is basically take the lab and put it in the patient,” said Dr. Cima.

The devices, which could be implanted at the time of biopsy, also could be tailored to monitor chemotherapy agents, allowing doctors to determine whether cancer drugs are reaching the tumors. They also can be designed to measure acidity (pH) or oxygen levels, which reveal tumor metabolism and how it is responding to therapy.

The cylindrical, 5-millimeter implant is made of high-density polyethylene encased in a polycarbonate membrane with 10-nanometer-diameter pores. Magnetic nanoparticles coated with antibodies specific to the target molecules are loaded into the device. Target molecules enter the implant through the polycarbonate membrane, binding to the nanoparticles and causing them to clump together. That clumping can be detected by magnetic resonance imaging (MRI) because the aggregated nanoparticles produce a marked change in the MRI signal associated with the implanted device. The researchers observed measurable changes within 1 day of implantation.

In the published work, the investigators transplanted human tumors into test mice and then used the implants to track levels of human chorionic gonadotropin, a hormone produced by the human tumor cells. Dr. Cima said he believes an implant to test for pH levels could be commercially available in a few years, followed by devices to test for complex chemicals such as other hormones and drugs.

This work, which is detailed in the paper “Implantable diagnostic device for cancer monitoring,” was supported by the NCI Alliance for Nanotechnology in Cancer, a comprehensive initiative designed to accelerate the application of nanotechnology to the prevention, diagnosis, and treatment of cancer. An abstract is available at the journal’s Web site.

Provided by National Cancer Institute (news : web)