Editorial:

Pie Pans, Radio Waves, and Cancer

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Mr. John Kanzius was diagnosed with B-cell leukemia in 2003. He had gone through many rounds of chemotherapy, and it was making him quite sick. He also recalled seeing "… all the young people who lost their smiles during cancer treatment."[1] There is not much to smile about when you have an illness whose treatment makes you feel more miserable than the disease itself. John Kanzius thought that there must be a better way to treat cancer.

One night when he could not sleep, his wife awoke to the sounds of rattling pans in her kitchen. When she found her husband John tinkering with her pie pans in the middle of the night, she "thought he had lost it."[2]

But, John had not lost it at all. In fact, based on what subsequently occurred, one could say that John may have found it—a possible treatment for cancer that would not make people deathly ill.

John, a former owner of radio and television stations based in Erie, Pa., simply used his knowledge of what he knew best—radio waves. Using his wife's pie pans, John built the first prototype of what is now referred to as the Kanzius machine—a radio frequency (RF) generator used to treat cancer. "The basic idea," he said, "is to turn each cancer cell into a radio receiver with nanoparticles serving as antennae, then bombarding them with radio waves until they die from heat."[1]

Research Studies

One of the first studies using the Kanzius machine was conducted at the University of Texas M.D. Anderson Cancer Center in Houston.[3] Researchers used single-walled carbon nanotubes (SWNTs) exposed to a 13.56 MHz RF field in vitro in three human cancer cell lines to produce lethal thermal injury to the cancer cells. They then tested the treatment in rabbits that had hepatic VX2 tumors. The nanotubes were injected directly into the tumors, were immediately exposed to the RF field, and tumors were harvested 48 hours later to determine their viability. The rabbits tolerated the treatments well. The Kanzius treatment produced complete necrosis of the tumors. Tumors exposed to SWNT injection alone, or RF alone, remained viable, thus proving that it was the combination of RF and SWNTs that killed the malignant tumor cells.

Another study published in January of this year used gold nanoparticles (GNPs) in conjunction with the Kanzius machine to kill human hepatocellular (Hep3 B) and pancreatic cancer cells (Panc-1) in vitro.[4] Gold nanoparticles (5 nm diameter) were chosen as the intracellular RF receiver because gold is a good electrical and thermal energy conductor, the nanoparticles are reportedly not difficult to prepare, and it is relatively easy to bind antibodies, carbohydrates, and other pharmacologic agents to the gold nanoparticles. Their small size also allows them to penetrate the smallest capillary pores, thus allowing them to travel anywhere in the body. Gold nanoparticles are taken up by tumor cells via endocytosis, and they can be seen in intracellular vesicles using electron microscopy. In addition, gold has been used for many years in the treatment of rheumatoid arthritis, and is generally not considered to be cytotoxic. Studies in mice have also shown no hematological toxicity up to one year after injection of gold nanoparticles. And, in the current study using gold nanoparticles, there was no evidence that they produced any cytotoxicity, absent exposure to an RF field.

Researchers found a GNP dose-dependent cytotoxic effect with RF exposure. For malignant liver cells, a GNP dose of 67 μM/L and five minutes of exposure to RF (13.56 MHz) produced 99.8% cytotoxicity. For pancreatic cancer cells, the same dose of GNP at two minutes RF exposure produced 98.7% cytotoxicity. Exposure of these two malignant cell lines to RF alone also produced some cytoxicity, although significantly less cytotoxicity than the GNP RF combination. Powerful RF fields can produce heat via nonspecific ionic stimulation. It is thus clear that not all of the details with respect to RF power or other variables have been worked out. There were no control cells (non-tumor cells) in this study, so it is not known whether there is a differential effect of RF alone on tumor cells versus normal cells.

In Pursuit of the Ideal Cancer Treatment

The ideal treatment for cancer would include treatment that is effective and adaptable to different tumor types. It would be able to target and destroy even distant, microscopic metastases, irrespective of where they occur in the body. The ideal treatment would be highly selective in killing cancer cells with little or no effect on normal healthy cells. And, the ideal treatment would be noninvasive, with little or no toxicity or side effects.

The Kanzius machine, used with tumor-specific antibodies or other selective tumor targeting agents bound to gold nanoparticles, clearly has the potential for fulfilling these criteria. Moreover, the same type of Kanzius treatment could be used to treat viral, fungal, and bacterial infections by binding specific targeting molecules to the gold nanoparticles. This could provide a new and effective option for treating the growing problem of antibiotic-resistant infections.

Perhaps the most remarkable part of this story is the fact that John Kanzius had no federal grant, no fancy laboratory, and no academic tenure at any university. John Kanzius had only his pie pans and an idea that there just had to be a better way to treat cancer.

What John Kanzius had was the creativity and the dogged determination to find a solution to a problem that has heretofore eluded the so-called best and brightest researchers in oncology. As if that were not enough, Kanzius also discovered that his machine could be used to desalinate water using very little energy.[5]

So, the next time you sit down to eat pie, consider the little metal pie pan and what an amazing man did with it that may affect the future of cancer treatment.

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