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The next generation of cancer treatment could depend on something that's about 50 times smaller than an ordinary blood vessel. Microbubbles are gas-filled lipids that can float through the bloodstream, and UAB Comprehensive Cancer Center researchers are using them as a tool to develop more effective methods of fighting cancer.

Highlighting Cancer Cells

Microbubbles can be used diagnostically and therapeutically, says Eben Rosenthal, M.D., a head and neck surgeon and Cancer Center associate scientist. For one thing, they can provide specialists with a better view of what's happening inside the body.

"In many cases, when patients get a CT scan, they're given a contrast agent to highlight the blood vessels, making certain organs or tissues more visible," Dr. Rosenthal says. "However, ultrasound is limited to certain disease types in part because a contrast agent has not been developed." The microbubbles, however, might be able to identify tumors. They work like a contrast agent by improving both the sensitivity and the specificity of ultrasound during cancer imaging. The Cancer Center is currently conducting clinical trials combining microbubbles and ultrasound to measure their effectiveness in detecting thyroid and breast cancers.

Micro Movers

For therapeutic purposes, “we have found that we can actually put drugs in the bubbles and locally deliver them to the tumor,” says Cancer Center associate scientist Kenneth Hoyt, Ph.D., who is studying the effects of the microbubbles on breast cancer. “We’re now working on attaching antibodies to the bubbles to specifically target any cancer that has a receptor profile that is dominant over normal tissue. We can hone the microbubbles toward those tumors and thus improve the diagnosis and detection of the cancer. That’s the next generation of targeted therapy.”

Microbubbles offer other therapeutic advantages as well. When combined with ultrasound therapy, they can disrupt tumor cell membranes, essentially opening the doors for a greater influx of cancer drugs. The bubbles also can be used to administer viral therapy to tumors, which is a key breakthrough; using viruses to kill cancer cells is often difficult because the viruses tend to move to the liver. By using targeted microbubbles, the viruses go exactly where specialists want them to go.

A Millionth of a Meter

Physicians administer microbubbles by injection. They are extremely small, ranging in size from one to 10 microns—about 1/20th the size of a normal human cell. “A micron is one-millionth of a meter,” Dr. Hoyt says. “To put that in perspective, a human capillary is about 50 microns across.”

Drs. Hoyt and Rosenthal have already started clinical trials using microbubbles for targeted drug delivery. Dr. Hoyt also recently received a grant from the Cancer Center's Young Supporters Board to continue his work with the bubbles in treating breast cancer. While much more laboratory research lies ahead, the early results are encouraging.

"We're seeing improved tumor response when the microbubbles are administered with other anti-cancer agents. Furthermore, we can target the bubbles to certain tissues, so we can successfully increase the uptake of the bubbles in the tumor," Dr. Rosenthal says. "We've also shown in preclinical models that tumors respond better to chemotherapy when administered with the bubbles, meaning that we might be able to reduce the chemotherapy dose given to the patient. So conceivably, we can get the same effect with half the dose by using this technique, and that's very promising."