

Freezing out breast cancer

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Interventional radiologists have opened the door to an encouraging potential future treatment for the nearly 200,000 women who are diagnosed with breast cancer in the United States each year: image-guided, multiprobe cryotherapy. In the first reported study, researchers were able to successfully freeze breast cancer in patients who refused surgery; the women did not have to undergo surgery after treatment to ensure that tumors had been killed, note researchers at the Society of Interventional Radiology's 35th Annual Scientific Meeting in Tampa, Fla.

"Minimally invasive cryotherapy opens the door for a potential new treatment for breast cancer and needs to be further tested. When used for local control and/or potential cure of breast cancer, it provided safe and effective breast conservation with minimal discomfort for a group of women who refused [invasive surgery](#) or had a local recurrence and needed additional management," noted Peter J. Littrup, M.D., an interventional radiologist and director of imaging research and image-guided therapy for the Barbara Ann Karmanos Cancer Institute in Detroit, Mich. "This is the first reported study of successfully freezing breast cancer without having to undergo surgery afterward to prove that it was completely treated," he added. In the 13-patient study, no localized treatment recurrences were seen for up to five years, no significant complications were noted and women were pleased with the cosmetic outcomes, noted Littrup, who is also a professor of radiology, urology and [radiation oncology](#) at Wayne State University in Detroit. Cryotherapy was applied according to well-established freezing principles, and biopsies at the margins of the cryotherapy site

immediately after the procedure and at the cryotherapy site in follow-up were all negative—showing no cancer, said Littrup.

In the United States, a woman is diagnosed with breast cancer every three minutes and one woman will die from the disease every 13 minutes. A woman has about a 13 percent lifetime risk of developing breast cancer, with women 50 years of age and older accounting for approximately 80 percent of all breast cancers. For these women, as well as the thousands of men diagnosed each year, breast cancer treatments can be highly effective but often require invasive treatment options such as surgery and chemotherapy. Surgery offers the best chance for a cure. Until long-term data are available, interventional treatments—such as cryotherapy, thermal ablation and laser therapy—are reserved for women who cannot have—or have refused—surgery.

In this study's cryotherapy treatment, researchers used several needle-like cryoprobes that were evenly spaced and that were inserted through the skin to deliver extremely cold gas directly to the tumor to freeze it. This technique has been used for many years by surgeons in the operating room; however, in the last few years, the needles have become small enough to be used by interventional radiologists through a small nick in the skin, without the need for an operation. The "ice ball" that is created around the needle grows in size and destroys the frozen tumor cells. The major benefits of cryotherapy are its superb visualization of the ice treatment zone during the procedure, its low pain profile in an outpatient setting and its excellent healing with minimal scar, said Littrup. Breast imaging has markedly advanced by accurate improvements in breast magnetic resonance imaging (MRI), allowing for excellent treatment planning of tumor size and extent within the breast, as well as showing zones of destruction thoroughly covering the tumor after cryotherapy, he noted.

A major difference between this study and all prior uses of breast

cryotherapy is the confirmation of sufficient deadly temperatures when using two or more cryoprobes, said Littrup. Prior breast cryotherapy studies had "inexplicably" used only a single cryoprobe and suggested that tumors larger than 1.5 centimeters could not be adequately treated, he explained. "This is incongruent with more than 10 years of treating an entire prostate, which is approximately 5 centimeters, with more than six probes in order to generate well-defined sufficient deadly temperatures throughout the whole gland. We simply translated this concept to breast cancer in order to assure deadly temperatures well beyond all apparent tumor margins in order to generate successful use of cryotherapy in women," said Littrup. "This emphasizes the important role of an interventional radiologist in pioneering image-guided therapy by appropriately using established treatment technology—let alone emerging ones—to deliver a sufficient treatment dose, rather than only relying on the organ-specific expertise of other subspecialized physicians," said Littrup. "An interventional radiologist can better focus on the image-guidance similarities of nearly any treatment technology and thereby help lead the effort of improved cancer treatments for many organ sites," added the co-author of "Cryotherapy for a Spectrum of Breast Cancer: US and CT-guidance."

Surgeons and radiation oncologists have long tried to provide at least a 1-centimeter margin of treatment surrounding all aspects of a localized breast cancer, and it was important to ensure a similar "surgical margin" of lethal temperatures beyond all tumor margins by cryotherapy in this study, said Littrup. "The well-visualized ice margin by ultrasound CT or MR is actually only the 0-degree Celsius line, or isotherm, which is not sufficiently lethal to cancer cells, but has unfortunately been confused with the actual treatment margin. We made sure that the lethal isotherm of approximately -30 degrees Celsius extended beyond all tumor margins," said Littrup.

After breast MRI and thorough consultation, patient consents were

obtained for institutional review board-approved breast cryotherapy. In 13 cryotherapy sessions, 25 breast cancer foci were treated in 13 patients, stages 1-2, using multiple 2.4-millimeter cryoprobes. Using only local anesthesia with mild sedation, ultrasound guidance alone was used in six patients; seven patients required both CT and ultrasound to better define ice margins. MR and/or clinical follow-up were available for up to 65 months after cryotherapy. Pretreatment breast tumor diameter was 1.7 ± 1.2 centimeters (range, 0.5 - 0.8 centimeters) and an average of 3.3 cryoprobes produced ice diameters of 5.2 ± 2.2 centimeters (range, 2 centimeters).

"With recent developments of powerful new cryotechnology, multiple directions for breast cryotherapy can be pursued, including translating the current, somewhat challenging, procedure done with ultrasound and/or CT guidance to a more consistent and reproducible MR-guided approach," said Littrup. Cryotechnology promises to be more MR-compatible and would also allow accurate targeting of more difficult-to-see breast tumors. More importantly, larger studies in multiple centers needs to be done, following these basic cryobiology principles of sufficient lethal temperatures generated by multiple cryoprobes spaced evenly throughout a [breast cancer](#) region, he added.

Provided by Society of Interventional Radiology

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