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NEWS

RSNA Press Release

Ablation Therapy Destroys Breast Cancer Without Scarring

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At A Glance

- Image-guided thermal ablation effectively treats breast cancer with minimal discomfort and no scarring.
- Thermal ablation uses electrical current, laser or liquid nitrogen to destroy cancerous cells.
- Using ultrasound or magnetic resonance (MR) guidance, the physician can precisely target the tumor.

NEW YORK CITY - Image-guided thermal techniques that kill tumors without open surgery or scarring may soon allow women diagnosed with breast cancer to avoid disfigurement to be rid of the disease.

"We don't have to deform women in order to destroy their cancer," said Steven A. Harms, M.D., professor of radiology and director of imaging research, University of Arkansas for Medical Sciences in Little Rock.

"I believe this is a treatment that women will begin to demand because it offers everything," Dr. Harms said. "It's an effective outpatient procedure with minimal discomfort that delivers the ultimate cosmetic result: no scars and no deformity."

Ablation therapy utilizes ultrasound or magnetic resonance (MR) imaging to guide a thermal device to the site of a breast tumor. "Ultrasound is an easy guidance method. A high contrast, high resolution MRI is essential for defining the extent of the disease. This is a major revolution. We are seeing and treating breast cancer better than ever before," Dr. Harms said.

There are three types of thermal ablation:

- Radiofrequency ablation treats tumors with heat produced by an electrical current. The radiologist positions the needle-electrodes around the tumor, where a temperature of approximately 60° C (140° F) is applied for 15 minutes to destroy malignant tissue.
- Laser ablation uses a highly concentrated beam of light to penetrate the cancerous tissue. The laser energy is emitted from an optic fiber placed within a needle positioned at the tumor's center by the radiologist.
- Cryotherapy uses liquid nitrogen to freeze and kill abnormal tissue. After

numbing the breast tissue around the mass, the radiologist inserts a cryoprobe, which is shaped like a large needle, into the middle of the lesion. An iceball forms at the tip of the probe and continues to grow until the images confirm that the entire tumor has been engulfed, killing the tissue.

Dr. Harms spoke about the procedures today at a Radiological Society of North America (RSNA) media briefing on women's breast health.

"A key advantage of image-guided ablation is that the physician can visualize the ideal treatment zone and effectively destroy the tumor and a margin of tissue surrounding it," Dr. Harms said.

Dr. Harms and physicians at the University of Arkansas for Medical Sciences (UAMS) in Little Rock have performed over 50 thermal ablations on breast cancer patients followed by traditional surgery. Serial section MR images and pathological studies of the breasts indicated that the procedure successfully destroyed all of the cancerous cells.

As a result, UAMS plans to offer thermal ablation as a treatment for solitary small tumors (1.5 centimeters or smaller-about the size of a gumball). Following the procedure, patients typically receive radiation therapy and/or chemotherapy, just as they would following surgical treatment of breast cancer.

"Within a few days or weeks the inflammation goes away. After a year, there's nothing left to see. The patient looks like she did before she developed cancer," Dr. Harms said.

According to Dr. Harms, additional tools, clinical trials and physician training are needed before thermal ablation can become more widespread.

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The pre-treatment RODEO MRI image (left) demonstrates a high intensity breast cancer in diameter. The RODEO MRI image after treatment (right) shows a dark area representing the cancer destroyed by the laser heat. Pathology confirmed that 100% of the cancer was ablated. The patient stated in an interview after treatment that the next morning she was performing ordinary household chores. She is 84 years old.

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Figure 1. Photograph of the tip of a needle electrode with prongs deployed.

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Figure 2. Longitudinal sonogram shows a 1.1 cm invasive ductal carcinoma with margins that are set well apart from the surrounding fat. Note the internal calcification.

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Figure 3. Intra-operative photograph shows the lateral compression applied to the breast during the entire RF ablation procedure to ensure a safe distance between the tumor and the skin in front and between the tumor and the chest wall behind it.

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Figure 4. Figure4: Intra-operative photograph shows insertion of the needle electrode into the lesion, with the needle electrode as parallel to the chest wall as possible.

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Figure 5. (a) Ultrasound monitoring to ensure accurate placement of the RF device in the geometric center of the tumor to be ablated. Sonogram shows the tip of the needle electrode (arrows) in contact with the tumor.

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Figure 5. (b) Sonogram shows two prongs (arrows) traversing the central portion of the tumor.

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Figure 5. (c) Sonogram shows the cross sections of the deployed prongs (arrows) in the center of the lesion, confirming the accurate three-dimensional placement of the RF device.

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Figure 6. Drawing illustrates the RF ablation device correctly placed so as to produce a thermal lesion volume (black outline) that has the same center as the tumor and that encompasses the tumor and a sufficient margin of noncancerous tissue.

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Figure 7. (a) Monitoring of temperatures at the tip of the RF device prongs. Control panel of the RF generator. The temperatures at the tip of the prongs, the power output, and the tissue impedance are displayed in real time on the screen of the laptop computer on top of the generator.

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Figure 7. (b) After RF ablation, laptop monitor screen shows graphs of the temperatures recorded at the tips of the five prongs over time (*top*) and of the impedance of the tissues and the power output of the generator (*bottom*).

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Figure 8. (a) Photograph of gross breast tissue specimen resected after RF ablation. Mastectomy specimen has a reddish ring (*arrows*) that defines the extent of the ablation zone.

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Figure 8. (b) Photograph of gross breast tissue specimen resected after RF ablation. Close-up view of the specimen shows the well-defined tumor (*arrows*) in the center of the ablation zone.

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Figure 9. Magnified section of ablated invasive ductal carcinoma tissue shows a negative reaction to NADH-diaphorase stain, which confirmed the absence of viable tumor cells after RF ablation.

RSNA is an association of more than 35,000 radiologists, radiation oncologists and related scientists committed to promoting excellence in radiology through education and by fostering research, with the ultimate goal of improving patient care. The Society is based in Oak Brook, Ill. (http://www.rsna.org)

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