Microwave Thermotherapy for Breast Cancer

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Coverage Policy

Microwave thermotherapy is considered experimental, investigational or unproven for the treatment of breast cancer.

Overview

This Coverage Policy addresses microwave thermotherapy for the treatment of breast cancer.

General Background

Breast cancer is the most common form of cancer among women. In situ breast cancer is confined within the ducts (i.e., ductal carcinoma in situ) or lobules (i.e., lobular carcinoma in situ). Invasive or infiltrating carcinomas start in the ducts or lobules and invade the surrounding fatty tissue.

Treatment of breast cancer will depend upon the type and stage of cancer, patient’s age and comorbidities, and the risks and benefits associated with the various treatment options. Surgical intervention is the standard of care for most breast cancers. Surgical options include breast-sparing surgery (e.g., lumpectomy, segmental mastectomy, partial mastectomy) and total mastectomy. Surgical treatment may be combined with other therapies, such as chemotherapy, radiation therapy, immunotherapy and/or monoclonal antibody therapy.

Microwave Thermotherapy
Less invasive breast cancer treatment modalities are currently being studied. Some of these modalities include breast cancer ablation as part of the initial treatment regimen. One cancer ablation technique that is currently under investigation involves the use of microwave heating or thermotherapy of the tumor.

Microwave thermotherapy or microwave therapy is a type of treatment in which body tissue is exposed to high temperatures to damage and kill cancer cells or to make cancer cells more sensitive to the effects of radiation and certain anticancer drugs.

Microwave thermotherapy is being proposed as a possible first-line treatment in lieu of conservative breast surgery (i.e., lumpectomy) with postsurgical radiation, and also as an adjunct to chemotherapy as a pre- or postoperative measure. Because breast carcinomas have higher water content than normal breast tissue, they absorb more heat and incur more damage than the surrounding tissue when the area is precisely targeted with regulated microwave heat for a consistent period of time. Researchers have proposed that tumor cell heating alone for 60 minutes at 43°C (Centigrade) or 109°F (Fahrenheit) is tumoricidal and that the period of time necessary to kill tumor cells decreases by a factor of two for each degree of increase in temperature above approximately 43°C (Varga, et al., 2004; Gardner, at al., 2002).

To heat the breast, two microwave phased-array waveguide applicators are placed a few millimeters from the patient’s skin. These applicators contain fans that assist in cooling the skin’s surface during the heat application. The patient is placed in a prone position, and the breast is compressed approximately four to eight centimeters (cm) between the microwave applicators. Five surface temperature sensors are attached to the skin for continuous monitoring. Two probes are inserted into the breast: one acts as a thermal sensor to monitor the internal tumor temperature, while the other assists in focusing the directed microwave energy into the tumor. Computer-controlled display monitoring occurs throughout the therapy session. Treatment is considered complete when the desired thermal dose is delivered to the tumor or a maximum treatment time (i.e., 40 minutes) is reached. To assist in preventing skin damage from the redundant heat, additional auxiliary fans are used to cool the air surrounding the patient. Once the desired thermal dose is achieved, the microwave power is reduced to zero, and the breast compression is maintained during a five-minute cool-down period. During this period, because of the thermal insulation of the surrounding breast tissues, the thermal dose continues to accumulate in the tumor (Gardner, et al., 2002).

U.S. Food and Drug Administration (FDA)
To date, the FDA has not approved the use of microwave thermotherapy device(s) for the intended treatment of breast cancer. Several microwave ablation systems have received 510(k) approval from the FDA as Class II devices for the intended use of for soft tissue ablation (FDA product code: NEY).

Literature Review
The studies that have been conducted on microwave thermotherapy for the treatment of breast cancer have been small in sample size and have used various treatment protocols to determine the most effective temperature and the length of treatment sessions that are needed for tumoricidal effects to be obtained. Total ablation of all tumor/cancer cells has yet to be obtained while numerous adverse events have occurred. It is unknown at this time what long-term effect microwave thermotherapy will have on breast tissue conservation and effective cancer ablation.

In a recent review of clinical studies, Dooley et al. (2010) reported the results of four clinical studies of preoperative microwave thermotherapy for treating invasive carcinomas in the intact breast. The authors concluded that further investigation in larger randomized clinical studies for the use of microwave thermotherapy both as a preoperative heat-alone treatment to reduce positive margins for early-stage breast cancer and as a preoperative combination heat and chemotherapy treatment to reduce tumor volume for large breast cancer tumors to improve breast conservation are needed.

In 2002, Gardner et al. reported on a case series FDA-approved Phase I pilot study using thermotherapy for the treatment of primary breast cancer. The purpose of this study was to measure thermal effectiveness on the local lesion and to determine whether heat could eradicate all cancer cells within the breast. Ten volunteers with breast cancer lesions that varied in size from one to eight centimeters (cm) (mean = 4.3 cm) each received one thermotherapy treatment prior to mastectomy. A FDA Investigational Device Exemption--approved two-channel
915-MHz microwave adaptive phased array thermotherapy system Microfocus-1000™ APA (Celsion Corporation, Columbia, MD) was used in this study. The mastectomy specimens were histologically evaluated to document the impact of the thermotherapy. Eight specimens showed tumor shrinkage or ischemic necrosis, while six histological stainings documented 82–97% tumor cell destruction (mean = 89.7%). Pretreatment imaging did not reveal ischemic necrosis to be present in any patient. When ultrasound imaging and the pathology results were compared, the ultrasound images showed that in six of the 10 patients, tumor size reduction ranged from 29–60% (mean = 41%) in 18 days or less. The mastectomy specimens showed that in four of the 10 patients, significant ischemic tumor necrosis estimated at 40–60% (mean = 48%) had occurred, and in six of eight patients, tumor cell destruction was estimated at 82–97% (mean = 87%), based on apoptosis measurements. Adverse events included rapid elevation of surface temperature, flap necrosis after mastectomy for three patients, and one skin blister. The researchers concluded that it is possible that a longer observation time between thermotherapy and surgery could have increased tumor cell destruction and tumor size reduction. The pathology data of this study suggest that achieving a 60-minute thermal dose and a peak temperature of >45°C may correlate with the onset of ischemic tumor necrosis, but higher peak temperatures would most likely be required to increase tumor necrosis of advanced breast carcinomas.

Vargas et al. (2004) reported on an uncontrolled, prospective, multicenter, nonrandomized dose escalation study of 25 patients. A FDA Investigational Device Exemption–approved two-channel 915-MHz microwave adaptive phased array thermotherapy system Microfocus-1000™ APA (Celsion Corporation, Columbia, MD) was used in this study. Tumoricidal temperatures (i.e., >43°C or 109.4°F [Fahrenheit]) were reached in 23 patients. Prior to thermotherapy, the mean ultrasound measurement of the lesions was 17.6 millimeters (mm) (range = 7–25 mm), but after thermotherapy there was no significant change in tumor size (i.e., 18.4 mm). After an average of 17 days, all patients underwent breast-conserving surgery. The surgical pathology reports showed tissue necrosis in 17 patients. Although complete ablation occurred in two patients, carcinoma in situ was still present at the borders of their surgical specimens. Another patient had one remaining cluster of cancer cells with a 99.9% ablation of the remaining tumor. In the cohort receiving 120 CEMs, there were 19 adverse events, including severe pain, mild erythema, edema, and second- and third-degree burns. Although this study showed that pathological tumor necrosis occurred, the presurgical diagnostic films showed no uniform decrease in tumor response to thermotherapy. Additional studies are needed to determine the cause of tissue edema, the exact treatment time needed, and the safety measures that need to be in place for the use of thermotherapy.

Professional Societies/Organizations

The National Comprehensive Cancer Network® (NCCN®) national guidance that is published for the treatment of breast cancer does not mention the use of microwave thermotherapy specifically. Under 'Distance sites of recurrence requiring consideration of therapies local to the metastatic site’, the NCCN states the panel recommends use of hyperthermia be limited to treatment centers with appropriate training, expertise and equipment. The NCCN noted the addition of hyperthermia generated substantial discussion and controversy among the panel and is a Category* 3 recommendation (NCCN® Breast Cancer 3.2017).

*The NCCN® recommendations are defined as:
  - Category 1: Based upon high-level evidence there is uniform NCCN consensus that the intervention is appropriate,
  - Category 2A: Based upon lower-level evidence there is uniform NCCN consensus that the intervention is appropriate,
  - Category 2B: Based upon lower-level evidence there is NCCN consensus that the intervention is appropriate and
  - Category 3: Based upon any level of evidence, there is major NCCN disagreement that the intervention is appropriate.

The ASBS Consensus Guideline on the Use of Transcutaneous and Percutaneous Methods for the Treatment of Benign and Malignant Tumors of the Breast (Approved June 22, 2017) noted that ablative and minimally invasive percutaneous excisional treatments for early stage breast cancer are being investigated by various groups. Techniques being evaluated include ablation by focused ultrasound, laser, cryotherapy, microwave, and radiofrequency. The ASBS included the recommendations for percutaneous and/or transcutaneous treatments of malignant tumors of the breast:
Percutaneous and/or transcutaneous treatments of malignant tumors of the breast are not specifically approved by the FDA, though some ablative technologies are approved for treatment of benign and malignant soft tissue tumors. Therefore, ablative and percutaneous excisional treatments for breast cancer are considered investigational and should not be performed outside the realm of a clinical trial.

According to the American Cancer Society (ACS), hyperthermia is a promising way to improve cancer treatment, but it is largely an experimental technique at this time. It requires special equipment, and a doctor and treatment team who are skilled in using it. Because of that, it’s not offered in all cancer treatment centers. Many clinical trials of hyperthermia are being done to better understand and improve this technique. Researchers continue to look at how hyperthermia is best used along with other cancer treatments to improve outcomes (ACS, 2016).

On the National Cancer Institute (NCI) website, under Treatments, Hyperthermia in Cancer Treatment, the NCI states that a number of challenges must be overcome before hyperthermia can be considered a standard treatment for cancer. Many clinical trials are being conducted to evaluate the effectiveness of hyperthermia. Some trials continue to research hyperthermia in combination with other therapies for the treatment of different cancers. Other studies focus on improving hyperthermia techniques (NCI, 2011).

The American Board of Internal Medicine’s (ABIM) Foundation Choosing Wisely® Initiative
No relevant information.

Use Outside of the US
No relevant information.

Coding/Billing Information

Note: 1) This list of codes may not be all-inclusive.
2) Deleted codes and codes which are not effective at the time the service is rendered may not be eligible for reimbursement.

Considered Experimental/Investigational/Unproven when used to report microwave thermotherapy for the treatment of breast cancer:

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<tr>
<th>CPT® Codes</th>
<th>Description</th>
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<tbody>
<tr>
<td>19499</td>
<td>Unlisted procedure, breast</td>
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<tr>
<td>0301T</td>
<td>Destruction/reduction of malignant breast tumor with externally applied focused microwave, including interstitial placement of disposable catheter with combined temperature monitoring probe and microwave focusing sensocatheter under ultrasound thermotherapy guidance (Code deleted 12/31/2017).</td>
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References


