Microwave thermotherapy for breast cancer

Clinical Policy ID: CCP.1397

Recent review date: 11/2024

Next review date: 3/2026

Policy contains: breast cancer, focused microwave phase array thermotherapy, microwave thermotherapy.

Coverage policy

Microwave thermotherapy for breast cancer is investigational/not clinically proven, and, therefore, not medically necessary.

Limitations

No limitations were identified during the writing of this policy.

Alternative covered services

- Chemotherapy.
- Hormone therapy.
- Lumpectomy.
- Mastectomy.
- Radiation therapy.
- Stem cell transplant.
- Targeted therapy.

Background

Breast cancer is the most commonly diagnosed cancer in the United States. Trends in the U.S. population reveal an increased incidence of lower-risk breast cancers and ductal carcinoma in situ attributed to screening mammography, and lower mortality rates attributed to screening and improved treatment. The National Cancer Institute estimated that, in 2022, 287,850 new cases of invasive disease and 51,400 cases of breast ductal carcinoma in situ would be diagnosed, and 43,250 deaths would occur among American women. The rates of locoregional recurrence have decreased over time and were estimated at less than 3% in patients treated with breast-conserving surgery and radiation therapy (National Cancer Institute, 2023.

A variety of treatment options are being sought to improve on these trends. One such treatment is microwave thermotherapy, also known as focused microwave phase array thermotherapy, which is intended for breast cancer in addition to some other cancers.

Thermotherapy works on the principle that heat applied to the organ in question (in this case, the breast), generates antitumor activity. Typically, thermotherapy raises the temperature of the breast to 42° to 45° Celsius. The heating treatment works by producing cytotoxic effects that yield the denaturation of cytoplasmic/membrane tumor proteins, by decreasing blood flow which impairs the oxygen and nutrient supply to the tumor, and by activating heat shock proteins that help destroy breast tumors.

In microwave thermotherapy, the breast is compressed between two microwave applicators with fans that help cool the skin's surface. Five sensors are attached to the skin to monitor skin temperature during treatment. Two additional sensors are inserted in the breast — one to monitor breast temperature, and the other to direct microwave energy into the cancerous tissue (Fiorentini, 2020).

In addition to the microwave thermotherapy method described above, thermotherapy for breast cancer patients can be rendered in several ways. These include a Sigma 60 applicator, or a radiant system for whole-body hyperthermia. These treatments typically take one hour. Other types of thermotherapy can be given when heating is induced by far infrared radiation, which heats the blood under the skin, and gradually heats the entire body (Alphandery, 2014).

Thermotherapy is not used as monotherapy, as it is unable to effectively treat breast cancer by itself. Instead, it may be combined with other commonly used treatments:

- Breast cancer treatments with radiation therapy are limited in some cases because a dose that would eradicate the cancer entirely could cause life-threatening conditions. In these cases (often advanced breast cancer), thermotherapy may be employed after radiation.
- In cases of metastatic breast cancer treated with chemotherapy, combining chemotherapy with thermotherapy may increase the effectiveness of treatment.
- Targeted treatment of breast cancer can be conducted together with hyperthermia. In this scenario, heating the organ can ensure delivery of the antitumor drugs specifically at the tumor location, enabling the release of the drugs specifically to the tumors.
- Combining thermotherapy with cryotherapy can potentially enable the reduction of the size of large breast tumors (Alphandery, 2014).

Findings

The National Comprehensive Cancer Network guideline for breast cancer treatment does not address the use of focused microwave thermotherapy as a treatment option (National Comprehensive Cancer Network, 2024). The American Society of Breast Surgeons issued a consensus guideline in 2017 on transcutaneous and percutaneous methods of treating breast cancer and updated it in 2018. The Society stated that while

thermotherapy are being investigated, they are not approved by the U.S. Food and Drug Administration, and should not be performed, except in clinical trials (American Society of Breast Surgeons, 2018).

Minimally invasive thermal ablation, of which microwave thermotherapy is one type, has been used on breast cancer patients, and results have been reported in the literature. One systematic review determined that minimally invasive thermal treatment to destroy small breast cancers was promising, despite the fact that all studies were feasibility or pilot studies. The proportion of patients achieving complete tumor ablation using microwave ablation was just 0% to 8%, well below the percentages of those achieving complete tumor ablation with cryoablation, laser ablation, or ultrasound ablation (Liu, 2010).

Studies of thermotherapy have followed. Results have typically found that thermotherapy added to radiation therapy has been effective in controlling superficial recurrences in breast cancer, which often metastasize, although it is not yet the standard of care in treatment of recurrences (Zagar, 2010).

Only a small number of systematic reviews of microwave thermotherapy for breast cancer exist, and these articles are summarized below. A major limitation of these studies is that virtually none of the randomized controlled trials (other than the early clinical trials) are included, making judgment on effectiveness and safety of thermotherapy elusive compared to other breast cancer treatments.

A systematic review of 34 studies (n = 2,100) divided subjects with locally recurrent breast cancer into single- and double-arm groups. In the eight two-arm studies, a complete response was achieved in 60.2% of patients with radiation therapy and thermotherapy, compared to just 38.1% of those with radiation therapy only (P < .0001). The 63.4% complete response for single-arm studies was comparable to that for two-arm studies. Authors conclude that treatment is more effective when thermotherapy is added to radiation therapy for breast cancer patients (Datta, 2016).

Microwave thermotherapy has been compared with other techniques for minimally invasive ablation for breast cancer. One review of 45 studies (n = 1,156) included radiofrequency, microwaves, laser, cryoablation, and high-intensity focused ultrasound. Differences between techniques were not significant for technical success (P = .449), major complications (P = .181), or minor complications (P = .762) — but were significant for technique efficacy (P = .009). Results indicate that microwave thermotherapies are technically successful, but their efficacy remains suboptimal (Mauri, 2017).

A systematic review of 23 articles (n = 2,330) evaluated the efficacy of hyperthermia therapy for breast cancer while radiotherapy is being administered. Thirty-two hyperthermia therapy parameters were tested. In reporting studies, a significant positive outcome included complete response (10/15 studies); duration of local control (10/13); overall survival (2/2); and thermal toxicity (7/11). Patients who received a high thermal dose had on average 34% more complete responses than those who received a low thermal dose (Bakker, 2019).

A literature review identified multiple studies of breast cancer patients with liver metastasis treated with thermal therapy plus chemotherapy or surgery. Microwave ablation, laser-induced thermotherapy, and radiofrequency ablation had similar outcomes for positive responses (62.5%, 98.2%, and 63% — 97%); local tumor progression (9.6%, 2.9%, and 13.5% — 58%); and five-year survival (29%, 35%, and 27% —30%) (Vogl, 2013).

A systematic review of nine studies (n = 1,410) found the combination of hyperthermia and radiation therapy for breast cancer resulted in clinical responses ranging from 52.7% to 76%, with one- , three- , and five-year local control rates of 53% — 76%, 25% — 78%, and 39% — 65% (Fiorentini, 2020).

A literature review analyzed preliminary studies of microwave ablation for early-stage breast cancer (Carriero, 2023). One of the studies analyzed (n=64) compared microwave ablation with nipple-sparing mastectomy for treating specific invasive ductal carcinoma cases; findings indicated tumor control was comparable, and microwave ablation offered better cosmetic results. A second study focused on a multicenter clinical study (n=35) for microwave ablation and a smaller group (n=13) for surgery to assess microwave ablation's local effect and

antitumor immune response in early-stage breast cancer (Carriero, 2023). The results after 36 months, confirmed successful complete ablation in 91.4% of those treated with microwave ablation. Additionally, microwave ablation demonstrated some potential for enhancing antitumor immunity, though the long-term implications remain unexplored (Carriero, 2023).

In 2022, we updated the references, removed older references, and added no newrelevant literature to the policy. The coverage statement was modified to focus the policy solely on breast cancer.

In 2023, we updated the references, removed older references, and added no newly relevant literature to the policy.

In 2024, we updated references and found no new relevant literature was found and no policy changes were warranted.

References

On October 11, 2024, we searched PubMed and the databases of the Cochrane Library, the U.K. National Health Services Centre for Reviews and Dissemination, the Agency for Healthcare Research and Quality, and the Centers for Medicare & Medicaid Services. Search terms were “hyperthermia, induced (MeSH),” “microwave (MeSH),” “breast neoplasms (MeSH),” “minimally invasive thermal ablation,” and “microwave thermotherapy.” We included the best available evidence according to established evidence hierarchies (typically systematic reviews, meta-analyses, and full economic analyses, where available) and professional guidelines based on such evidence and clinical expertise.

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Policy updates

7/2018: initial review date and clinical policy effective date: 8/2018

11/2019: Policy references updated. Policy ID changed to CCP.1397.

11/2020: Policy references updated.

11/2021: Policy references updated.

11/2022: Policy references updated. Coverage modified.

11/2023: Policy references updated.

11/2024: Policy references updated.