

Using Proton Therapy to Treat Breast Cancer

Overview

Proton therapy is a powerful treatment tool for fighting breast cancer, and it is now available to patients at the Maryland Proton Treatment Center (MPTC). Physicians at MPTC use the latest pencil-beam scanning (PBS)/intensity modulated proton therapy (IMPT) to target tumors and deliver high doses of radiation with unmatched precision. Using proton therapy, the tumor can receive higher doses of radiation, while sparing more surrounding healthy tissue.¹

For breast cancer patients, proton therapy has the potential to lead to fewer short- and long-term side effects, particularly to the heart, lung, and lymphatic channels. In 2013, a paper published in the *New England Journal of Medicine* showed a critical link between increasing radiation dose to the heart and long-term cardiac morbidity, with no safe threshold.² Consequently, it is now thought that any decrease in radiation dose to the heart can be meaningful for a patient's long-term cardiac health, particularly in patients with other cardiac risk factors.

Breast Cancer Patients Who May Benefit from Proton Therapy

Some women with breast cancer will have a greater benefit from proton therapy than others, such as the following:

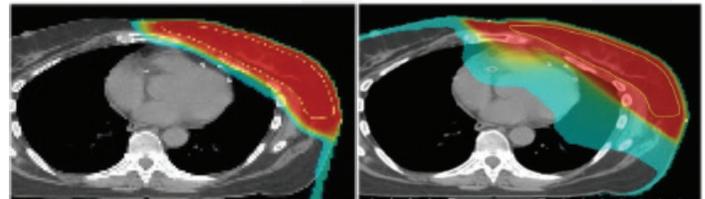
- **Patients with left-sided breast cancers:** Because of the heart's proximity to the breast, chest wall, and internal mammary lymph nodes, most women with left-sided breast cancer who are treated with radiation therapy receive some dose of radiation to the heart. Proton therapy can dramatically reduce radiation exposure to the heart and coronary vessels.
- **Patients with right-sided breast cancers receiving irradiation to their lymph nodes:** While photon therapy has been shown to deliver a clinically significant radiation dose to the heart and right coronary artery in these cases, proton therapy's precise targeting spares the heart and surrounding tissue.
- **Patients who have had prior chest radiation therapy:** When any part of the body is radiated a second time, the risk of short- and long-term side effects increases. For this reason, patients who have previously received radiation to the chest from prior cancers (breast, lung, lymphoma, etc.) are often good candidates for proton therapy's precision targeting.
- **Patients with disease recurrence:** Patients who have a recurrence of their disease in the chest wall/breast or lymph node regions can benefit from proton therapy in

two ways. First, proton therapy can aim a higher dose of radiation at the site of the recurrence, potentially leading to improved outcomes. Second, proton therapy's precision can reduce the radiation dose that surrounding normal tissues, including the heart and lungs, receive.

- **Young patients:** Breast cancer is usually a highly curable condition, which means many patients will live long enough to experience long-term side effects from radiation therapy. While there is no threshold below which radiation is risk free, proton therapy can expose a smaller volume of tissue to radiation, offering a benefit for patients with long life expectancies.
- **Patients with cardiac comorbidities:** Many breast cancer patients have preexisting cardiac comorbidities; additionally, many women receive cardio-toxic chemotherapy treatment. Because proton therapy spares cardiac tissue, it can be beneficial for these patients.

Proton Therapy Versus Photon Therapy

Proton therapy allows for higher doses of radiation to be delivered to the tumor without damaging surrounding healthy tissues and organs.



Proton therapy

Photon therapy

Proton therapy is given with the same logistical considerations as photon therapy. Patients undergo a CT simulation or planning session followed by treatment planning, then treatment delivery. Conventionally fractionated radiation therapy can be given when targeting lymph node basins, and hypofractionated ("short course") radiation can be given when treating the breast alone. Partial breast irradiation is also available for patients meeting eligibility criteria.

In a clinical trial of 100 women, "proton beam radiation therapy for partial breast irradiation produced excellent ipsilateral breast recurrence-free survival with minimal toxicity" and that "cosmetic results may be improved over those reported with photon-based techniques due to reduced breast tissue exposure with proton beam."³

¹"Early Toxicity in Patients Treated with Postoperative Proton Therapy for Locally Advanced Breast Cancer." *Int J Radiat Oncol Biol Phys*. 2015 Jun;92(2): 284-291.

²"Risk of Ischemic Heart Disease in Women after Radiotherapy for Breast Cancer." *N Engl J Med*. 2013;368: 987-998.

³"Partial breast radiation therapy with proton beam: 5-year results with cosmetic outcomes." *Int J Radiat Oncol Biol Phys*. 2014 Nov 1;90(3):501-5



Proton therapy can also be used in conjunction with external thermal therapy (hyperthermia) for chest wall recurrences. Hyperthermia therapy is available at our location in downtown Baltimore.

MPTC-Specific Clinical Trial Offerings

MPTC is dedicated to advancing scientific knowledge about the role of proton therapy in the treatment of breast cancer. All patients treated at the center have access to a wide range of clinical trials available through the Maryland Proton Alliance, including currently open and additional planned in-house and multi-institutional clinical trials.

Current clinical trials at MPTC include:

- NCT02603341: Pragmatic Randomized Trial of Proton Versus Photon Therapy for Patients with Non-Metastatic Breast Cancer Receiving Comprehensive Nodal Radiation: A Radiotherapy Comparative Effectiveness (RADCOMP) Trial
- NCT01766297: Phase II Protocol of Proton Therapy for Partial Breast Irradiation in Early-Stage Breast Cancer
- NCT01758445: Phase II Study of Postoperative, Cardiac-Sparing Proton Radiotherapy for Patients With Stage II/III, Loco-Regional, Non-Metastatic Breast Cancer Requiring Whole Breast or Chest Wall Irradiation with Lymph Node Irradiation
- NCT01255748: Evaluation Tracking Project: A Prospective Chart Review of Patients Treated with Radiation Therapy

For more information on our currently available clinical trials, **please call our research department at 410-369-5353.**

Outcomes

Your patients may be hesitant to explore new treatment options for breast cancer and may pose questions related to side effects and outcomes. Proton therapy is an effective, noninvasive, low-risk treatment option that can improve the quality of life for cancer patients and survivors. Studies are ongoing, and early results confirm this treatment's power and precision.

A study published in *Clinical Breast Cancer* concluded that proton treatment for partial breast irradiation provided "excellent disease control" with minimal side effects.⁴

In a 2016 study, proton therapy when given either after mastectomy or as breast-conserving therapy "significantly improves cardiac dose" and simultaneously improves irradiation doses to lymph nodes which can "positively impact long-term survival in breast cancer patients."⁵

About the Maryland Proton Treatment Center

The Maryland Proton Treatment Center is affiliated with the University of Maryland Marlene and Stewart Greenebaum Comprehensive Cancer Center, an NCI-designated comprehensive cancer center. MPTC is focused on clinical excellence, affordability, accessibility, as well as comfort and convenience for your patients. In addition, our team has initiated the Maryland Proton Alliance to bring the latest research and clinical trials to patients and physicians. We have taken a leadership role in the industry by offering proton therapy at the same cost as IMRT.

MPTC provides a unique level of proton therapy experience and expertise. Our University of Maryland Department of Radiation Oncology physicians have a combined 20-plus years of proton therapy experience. Associate Professor and MPTC Medical Director Charles Simone has more than 5 years of experience from the University of Pennsylvania Proton Therapy Center; Professor Robert Malyapa has more than 12 years of experience from the Paul Scherrer Institute, which is world renown as a key innovator of proton therapy, and University of Florida Proton Therapy Institute; Assistant Professor Adeel Kaiser has three years of experience from the Loma Linda Proton Therapy Center and Assistant Professor Shahed Badiyan trained at the Paul Scherrer Institute.

Contact Information

To refer a patient or to discuss treatment options with one of our physicians, please call **410-369-5200** or email us at **info@mdproton.com**.

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⁴ "Partial Breast Irradiation Delivered with Proton Beam: Results of a Phase II Trial." *Clin Breast Cancer*. 2011 Aug;11(4): 241-245.

⁵ "Initial Report of a Prospective Dosimetric and Clinical Feasibility Trial Demonstrates the Potential of Protons to Increase the Therapeutic Ratio in Breast Cancer Compared With Photons." *Int J Radiat Oncol Biol Phys*. 2016 May 1;95(1):411-21.