Using Proton Therapy to Treat Esophageal Cancer

MARYLAND PROTON TREATMENT CENTER
AFFILIATED WITH UNIVERSITY OF MARYLAND MARLENE AND STEWART GREENEBAUM COMPREHENSIVE CANCER CENTER

Overview

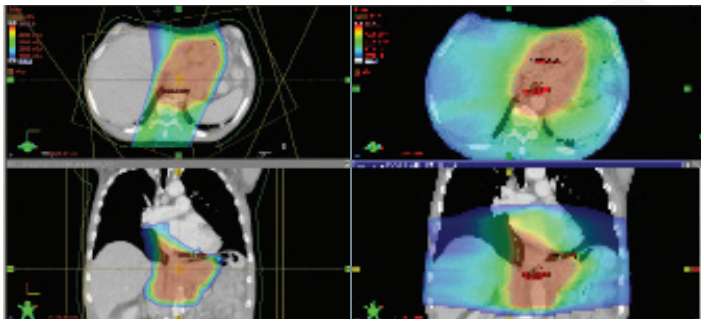
Patients with esophageal cancer have several treatment options at their disposal. One new treatment in the toolbox to fight cancer is proton therapy. Physicians at the Maryland Proton Treatment Center (MPTC) use the most advanced form of proton therapy, called pencil-beam scanning (PBS), or intensity modulated proton therapy (IMPT) to target tumors with unmatched precision, while minimizing damage to surrounding healthy tissue.

Delivery of radiation dose for esophageal cancers is limited by potential damage to the nearby heart and lungs. Radiation dose received by the heart and lungs is known to potentially cause both short-term and long-term complications, so minimizing dose to these important organs is critical. Given these risks, proton therapy can be an attractive option for patients with esophageal cancer because it is a noninvasive option that can substantially reduce the radiation dose to critical structures such as the lungs and heart.[1] A 2015 study comparing proton therapy with intensity modulated radiation therapy (IMRT) found that proton therapy "can further reduce mean lung/heart dose in esophageal cancer." [2, 3]

Studies have shown that proton therapy for esophageal cancer is well tolerated.[4] In addition to a reduced risk of normal tissue injury,[5] proton therapy may also allow for higher radiation dose to be safely delivered to tumor in the esophagus, which may provide a higher probability that the tumor will be controlled. Protons allow for re-irradiation.[6] Proton therapy may be used in esophageal cancer patients who receive chemoradiation prior to surgery, chemoradiation without surgery, or in patients who have had prior radiation for esophageal cancer. A 2015 study found that post-operative complications for esophageal cancer patients can be decreased by using proton therapy instead of traditional photon therapy.[7]

Proton therapy is likely to benefit:

- **Patients with operable or non-operable esophageal cancer:** The precision of proton therapy allows for a greater oncologic benefit to the patient while minimizing radiation dose to critical thoracic structures.
- **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 are often good candidates for proton therapy.
- **Patients with disease recurrence:** Proton therapy can aim a higher dose of radiation at the site of the recurrence, potentially leading to improved outcomes. Proton therapy's precision can reduce the radiation dose that surrounding normal tissues, including the heart and lungs, receive.



Proton therapy *Photon therapy*

Proton Therapy Versus Photon Therapy

Because of the physics of proton particles, proton radiation goes to the site of the tumor and stops. The image above shows the areas surrounding the esophageal tumor exposed to radiation (dose delivered to tumor and surrounding tissue shown in color) during treatment. Proton therapy (left) delivers significantly less radiation to the surrounding areas than the photon treatment (right).

[1] "Analysis of Intensity-Modulated Radiation Therapy (IMRT), Proton and 3D Conformal Radiotherapy (3D-CRT) for Reducing Perioperative Cardiopulmonary Complications in Esophageal Cancer Patients." Cancers (Basel). 2014 Dec;6(4): 2356-2368.

[2] "Comparing Proton Beam to Intensity Modulated Radiation Therapy Planning in Esophageal Cancer." Int J Particle Ther. 2015 Mar;1(4):866–877.

[3] "Comparison of adverse effects of proton and X-ray chemoradiotherapy for esophageal cancer using an adaptive dose-volume histogram analysis." J Radiat Res, 2015 May;56(3): 568-576.

[4] "Proton beam therapy and concurrent chemotherapy for esophageal cancer." Int J Radiat Oncol Biol Phys. 2012 Jul 1;83(3):e345-51

[5] Badiyan S et al. "Improving Outcomes for Esophageal Cancer using Proton Beam Therapy." Int J Radiat Oncol Biol Phys. 2016 May 1;95(1):488-97.

[6] "A Prospective Study of Proton Beam Reirradiation for Esophageal Cancer." Int J Radiat Oncol Biol Phys. 2016 May 1;95(1): 483-487.

MPTC-Specific Clinical Trial Offerings

MPTC is dedicated to advancing scientific knowledge about the role of proton therapy in the treatment of esophageal 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:

- NCT01255748: Evaluation Tracking Project: A Prospective Chart Review of Patients Treated with Radiation Therapy
- NCT01512589: Phase III Randomized trial of Proton Beam Versus Intensity-Modulated Radiation Therapy for the Treatment of Esophageal cancer *(coming soon)*

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

Published Research

The Maryland Proton Treatment Center is led by nationally recognized radiation oncologists from the University of Maryland School of Medicine who are involved in cutting-edge research and clinical trials. In 2016, Shahed Badiyan, MD, and Mark V. Mishra, MD published a multi-institutional review of dosimetric and clinical literature on treating esophageal cancer with proton therapy.[7]

Outcomes

Proton therapy's unique properties can improve outcomes for patients with esophageal cancer. A 2016 study found that "a growing body of evidence indicates that further risk reductions are achieved with proton beam therapy" as compared to photon therapy.[8] Another 2016 study, authored by MPTC Medical Director Charles B. Simone, II, MD, found that pencil beam scanning is associated with reduced toxicities, reduced postoperative complications and reduced hospital stays for esophageal cancer patients.[9]

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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[7] Badiyan S et al. "Improving Outcomes for Esophageal Cancer using Proton Beam Therapy." Int J Radiat Oncol Biol Phys. 2016 May 1; 95(1): 488-497.
[8] "Impact of Neoadjuvant Proton vs. Photon Chemoradiotherapy on Post-Operative Outcomes in Patients with Esophageal Cancer Treated with Trimodality Therapy: A Multi-Institutional Analysis." Int J Particle Ther, 2 (2015), pp. 79–80
[9] Simone CB et al. "Clinical outcomes and toxicities of proton radiotherapy for gastrointestinal neoplasms: a systematic review." J Gastrointest Oncol. 2016 Aug;7(4):644-64.