

# Using Proton Therapy to Treat Gastrointestinal Cancer

## Overview

Patients with malignancies of the gastrointestinal (GI) tract have several treatment options at their disposal. One new treatment tool in the toolbox to fight cancer for patients 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.

Proton therapy can be an attractive option for patients with GI cancers because it is a noninvasive option that can substantially reduce the radiation dose to critical structures such as the stomach, bowel, kidneys, bladder, and genitals.<sup>1</sup> Research studies have shown a decrease in acute side effects of radiation oncology for patients with anal and pancreatic cancers. In patients with liver tumors, proton therapy has been shown to result in excellent outcomes by allowing for dose escalation. Protons allow for re-irradiation in most GI organ sites, and proton therapy is safe to deliver concurrently with chemotherapy agents.

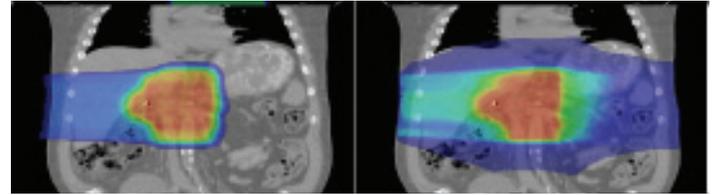
Proton therapy has demonstrated benefits for patients receiving radiation for GI cancers, including:

- Rectal and anal cancer
- Bile duct and pancreatic cancer
- Esophageal cancer
- Liver cancer

Proton therapy is likely to benefit additional patient subgroups, including:

- **Patients who have had prior 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 from prior cancers are often good candidates for proton therapy's precision targeting.
- **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 receive.

## Proton Therapy Versus Photon Therapy



Proton therapy

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).

## MPTC-Specific Clinical Trial Offerings

MPTC is dedicated to advancing scientific knowledge about the role of proton therapy in the treatment of GI cancers. 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.

Clinical trials at MPTC will soon include:

- NCT02200042: Randomized Phase III Study of Focal Radiation Therapy for Unresectable, Localized Intrahepatic Cholangiocarcinoma
- NCT01255748: Evaluation Tracking Project: A Prospective Chart Review of Patients Treated with Radiation Therapy (*available now*)

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.



Our team has published research demonstrating the potential benefit of proton therapy for use in patients with pancreatic cancer.

Nichols RC Jr, Huh SN, Prado KL, Yi BY, Sharma NK, Ho MW, Hoppe BS, Mendenhall NP, Li Z, Regine WF. "Protons Offer Reduced Normal-Tissue Exposure for Patients Receiving Postoperative Radiotherapy for Resected Pancreatic Head Cancer." *Int J Radiat Oncol Biol Phys.* 2012 May 1;83(1):158-63.

*By reducing small bowel and stomach exposure, protons have the potential to reduce the acute and late toxicities of postoperative chemoradiation in this setting.*

Further research from our team found that "proton beam therapy offers the potential to achieve significant reduction in treatment-related toxicities without compromising survival or local control for multiple GI malignancies."<sup>1</sup>

## Outcomes

In a 2016 study of patients with hepatocellular carcinoma, researchers found survival rates after proton therapy to be similar to those after transarterial chemoembolization. The study noted "a trend toward improved local tumor control and progression-free survival with proton beam" and also found that patients spent "significantly fewer" days in the hospital after proton therapy.<sup>2</sup>

A 2015 review of current studies examining proton therapy for patients with pancreatic cancer suggested that "protons appear to represent a superior modality for radiotherapy delivery to patients with unresectable tumors and those receiving postoperative radiotherapy. A particularly exciting opportunity for protons also exists for patients with resectable and marginally resectable disease."<sup>3</sup>

The results of a 2015 dosimetric study of squamous cell carcinoma of the anus indicated that scanning proton beam therapy "may spare 55–60% of bone marrow and small bowel of the gastrointestinal tract. With over 90% reduction in the mean dose to the genitalia we also anticipate avoiding sexual function impairment."<sup>4</sup>

Another study found that by reducing small bowel and stomach exposure, protons have the potential to reduce the acute and late toxicities of postoperative chemoradiation in this setting.<sup>5</sup>

## 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](mailto:info@mdproton.com).

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<sup>1</sup> Simone CB 2nd, et al. "Clinical outcomes and toxicities of proton radiotherapy for gastrointestinal neoplasms: a systematic review." *J Gastrointest Oncol.* 2016 Aug;7(4):644-64.

<sup>2</sup> "Randomized Clinical Trial Comparing Proton Beam Radiation Therapy with Transarterial Chemoembolization for Hepatocellular Carcinoma: Results of an Interim Analysis." *Int J Radiat Oncol Biol Phys.* 2016 May 1;95(1):477-482.

<sup>3</sup> "Proton Therapy for Pancreatic Cancer." *World J Gastrointest Oncol* 2015 Sep 15;7(9): 141-147.

<sup>4</sup> "Scanning proton beam therapy reduces normal tissue exposure in pelvic radiotherapy for anal cancer." *Radiother Oncol.* 2015 Dec; 117(3): 505–508.

<sup>5</sup> Regine WF et al. "Protons offer reduced normal-tissue exposure for patients receiving postoperative radiotherapy for resected pancreatic head cancer." *Int J Radiat Oncol Biol Phys.* 2012 May 1;83(1):158-63