

Proton therapy lowers risk of side effects in cancer compared to traditional radiation

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Study finds protons led to two-thirds reduction in unplanned hospitalizations.
Credit: Penn Medicine

Proton therapy leads to significantly lower risk of side effects severe enough to lead to unplanned hospitalizations for cancer patients when compared with traditional radiation, while cure rates between the two

groups are almost identical. The findings come from an expanded analysis of the largest review of its kind, performed by researchers in the Perelman School of Medicine at the University of Pennsylvania, to evaluate whether or not patients undergoing radiation therapy at the same time as chemotherapy experienced serious adverse events within 90 days. Researchers found proton therapy reduces the relative risk of these side effects by two-thirds. *JAMA Oncology* published the findings today.

"This is exciting because it shows that proton [therapy](#) offers a way for us to reduce the serious side effects of chemo-[radiation](#) and improve [patient health](#) and wellbeing without sacrificing the effectiveness of the therapy," said the study's lead author Brian Baumann, MD, an adjunct assistant professor of Radiation Oncology at Penn and an assistant professor of Radiation Oncology at Washington University School of Medicine in St. Louis.

Proton therapy has a few key differences from traditional photon radiation. Photon radiation typically uses multiple X-ray beams to deliver radiation to the tumor target but unavoidably deposits radiation in the normal tissues beyond the target, potentially damaging those tissues as the beam exits the body. Proton therapy is an FDA-approved alternative radiation treatment that directs positively charged protons at the tumor. They deposit the bulk of the radiation dose to the target with almost no residual radiation delivered beyond the target, reducing damage to surrounding healthy tissue and potentially reducing side effects.

For this study, researchers evaluated side effects including pain or difficulty swallowing, difficulty breathing, nausea, or diarrhea, among others. Researchers focused on grade-three effects or higher, defined as side effects severe enough for patients to be hospitalized. They evaluated data on 1,483 [cancer patients](#) receiving radiation and chemotherapy at

the same time. Of these, 391 patients received proton therapy, while 1,092 underwent photon treatment. All patients had non-metastatic cancer and were undergoing treatment intended to be curative. Patients with [brain cancer](#), head and neck cancer, lung cancer, gastrointestinal cancer, and gynecologic cancer treated with concurrent chemo-radiation were included.

The primary outcome was whether or not patients experienced adverse side effects that were grade-three or higher within 90 days of treatment. In the proton group, only 11.5 percent of patients (45) did, compared to 27.6 percent of patients (301) in the photon group. A weighted analysis of both patient groups, which controlled for other factors that may have led to differences between the patient groups, found that the relative risk of a severe toxicity was two-thirds lower for proton patients compared to photon patients.

"We know from our [clinical experience](#) that proton therapy can have this benefit, but even we did not expect the effect to be this sizeable," said senior author James Metz, MD, chair of Radiation Oncology, leader of the Roberts Proton Therapy Center at Penn, and a member of Penn's Abramson Cancer Center.

Importantly, overall survival and disease-free survival were similar between the two groups, suggesting that the reduction in toxicity seen with proton therapy did not come at the cost of reduced effectiveness. Researchers say these results hint at the promise of proton therapy as a way to deliver intensified systemic therapy and/or higher dose [radiation therapy](#) more safely, which could improve survival outcomes. In fact, data showed that while [older patients](#) with more comorbidities were more likely to receive proton therapy, they experienced fewer side effects.

"This tells us [proton](#) therapy may allow older patients to receive the most

effective combined treatments, and that older, sicker patients can more safely be included in clinical trials that use [proton therapy](#)," Baumann said.

While researchers say further research is needed, they point out that this study is the best information we have so far as randomized controlled trials continue to prove difficult to complete.

Provided by Perelman School of Medicine at the University of Pennsylvania

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