Reducing Chronic Stress May Improve Radiation Therapy's Effectiveness

Based on animal studies, researchers suggest that beta blockers may help.

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Could reducing stress improve the efficacy of radiation treatment for cancer? That's the implication of an animal study that finds that reducing chronic stress may even improve the treatment's ability to shrink tumors that are not hit by the radiation.

These findings come from a new study led by Elizabeth Repasky, PhD, of the Roswell Park Comprehensive Cancer Center in Buffalo, New York, which was published in Nature Communications.

Oncologists have long believed that radiation therapy typically doesn't have any effect on tumors that lie outside of its reach. But the new study suggests otherwise, and that chronic stress is a mediator of radiation's ability to affect tumors that it doesn't directly hit.

To test these hypotheses, the researchers submitted laboratory mice that had tumors (mammary, colon and melanoma) to very cold temperatures, which is known to increase physiological stress. They responded poorly to radiation treatment, compared to mice kept at more comfortable temperatures. When the researchers gave the cold mice propranolol, a beta-blocker drug that reduces physiological stress, their response to radiation also improved significantly.

"Our work suggests that the benefits of radiation therapy, both on the target site and in tumors located elsewhere in the body, are directly related to the degree of stress an individual may be experiencing," Repasky said in a press release. "In our laboratory studies, irradiated tumors went away faster when stress was reduced, and even distant tumors that did not receive radiation also shrunk or disappeared."

Repasky continued: "We have demonstrated that even a mild stress that occurs over a longer period of time—not just singular moments, but chronic stress—can significantly influence the efficacy of radiation therapy."

This introduces a catch-22, however, since cancer treatment itself can cause serious stress and anxiety. But that doesn't mean that reducing such stress isn't a viable goal.

"People often say, 'Stress is a part of life.' And while that's true, because there is frequently more stress that occurs in cancer patients because of their cancer diagnosis, we need to work to mitigate those enduring, longer-term stressors, because our work shows that it can inhibit the ongoing immune responses to cancer and an individual's response to therapy," said Minhui Chen, PhD, a senior postdoctoral researcher in Repasky's lab, and first author on the study.

The group's study looked at the body's "fight or flight" response to stresses through a network of nerves and organs that is called the adrenergic nervous system.

In laboratory experiments, the scientists found that turning down adrenergic stress lowered the levels of the neurotransmitters adrenaline and norepinephrine. This in turn led to greater control of tumors in both the sites that radiation targeted and in the places it did not. This benefit was also seen when the investigators reduced signaling through the beta2-adrenergic receptor. This suggested to them that blocking such signaling could augment the effects of radiation treatment.

Consequently, the research team is looking into conducting studies in humans that would further the line of inquiry they established in animal research. As a part of such research, they plan to seek to determine whether providing people with beta blockers, such as the common blood pressure medication propranolol, could also improve the efficacy of chemotherapy and immunotherapy.

To read a press release about the study, click here.

To read the study abstract, click here.

To learn more, see "Managing Stress When You Have Cancer."
