Fasting Before Chemo Protects Healthy Cells

Two days without food primed them for chemical onslaught and exposed cancer cells, study finds

By Alan Mozes
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TUESDAY, April 1 (HealthDay News) -- Fasting for two days before chemotherapy might protect cancer patients against the toxic side effects of these powerful drugs by shielding healthy cells while dooming malignant cells to destruction, new research suggests.

"The side effects of chemotherapy are one of the major obstacles in fighting the cancer, and this provides a calculated method to protect the great majority of non-cancerous cells," said study co-author Valter D. Longo, an associate professor of biological sciences at the Leonard Davis School of Gerontology and the Norris Cancer Center at the University of Southern California in Los Angeles.

The finding, which stems from test-tube work and experiments with yeast and mice, is part of a broad effort to explore ways to reduce the collateral damage that chemotherapy typically produces.

Although not yet replicated among patients, the preliminary animal research is encouraging: As little as 48 hours of starvation afforded mice injected with brain cancer cells the ability to endure and benefit from extremely high doses of chemotherapy that non-starved mice could not survive.

The finding was published in the March 31 online issue of the Proceedings of the National Academy of Sciences.

Longo noted that the idea first came from a different field of research: anti-aging science.

"We had found that healthy cells have a 'shield mode' -- a kind of protective strategy that allows the organism to be resistant to not just one but dozens of threats and stresses, including starvation," he said. "So we thought this characteristic might be a way to distinguish between normal cells and cancer cells when applying chemotherapy. And it turns out that it works for yeast, for human cells in test tubes, and here, in mice."

Following genetic manipulation of yeast to show that mimicking starvation could confer a life-prolonging protection against stress, the researchers induced glucose deprivation among a series of rat and human cell lines, some cancerous, some healthy.

This protected the healthy cells against exposure to toxic compounds, while leaving cancer cells unprotected.

In turn, the researchers then tested mice injected with brain cancer cells to see how they faired upon exposure to a high dose of the chemo drug etoposide. Noting that just one-third of this amount is considered to be the maximum for what is allowable for human treatment, Longo and his team compared results among mice starved for 48 hours and 60 hours pre-treatment with mice that were not starved.

While 43 percent of the non-starved mice died within 10 days of treatment, only one of the 48-hour starved mice died in that time. As well, while starved mice had lost 20 percent of their weight before treatment, most regained it back within four days of chemo exposure while the non-starved mice actually lost 20 percent of their weight post-treatment.

Non-starved mice also suffered toxic side effects, such as impaired movement, ruffled hair and poor posture. The 48-hour starved mice displayed no such problems.

Mice starved for 60 hours were exposed to even higher chemo doses. At that level, all non-starved mice died by the fifth day, at which point all the starved mice continued to survive. Again, almost all starvation weight loss was regained post treatment, and no signs of toxicity were evident.

Longo and his colleagues concluded that short-term starvation does appear to guard healthy cells and allow cancer treatment to attack only diseased cells. They said they are now organizing a human trial.

"We hope this works with patients, and we have reason to think it will," he said. "I think I'm more enthusiastic about this than anything else I've done. And you can see the potential for this being turned into something very, very useful. But we won't know until we do it."

Dwayne Stupack, an assistant professor of pathology with the Moores Cancer Center at the University of California, San Diego, described the current effort as a "reasonable" approach toward mitigating the undesirable effects of chemotherapy.

"We all know that people can go for a few days without eating, and it's not going to kill them, because the cells in our body are able to adjust and make do," he noted. "It's an intrinsic evolutionary stress response that is designed to keep those cells alive. And it turns out that this response also works to keep those healthy cells alive during chemotherapy."

"So, I think what they've done is very interesting and exciting, in the sense that the tumor they looked at is very aggressive, very lethal, and they were able to use what I would call relatively high chemotherapy without causing toxicity -- because the cells have already been conditioned to sort of shut down," Stupack said.

Stupack cautioned, however, that the starvation technique might not work for everyone. "There are certain tumors that may already be altering metabolism to normal tissue, and

certain populations of cancer patients among whom an intrinsic stress response to the cancer is already under way," he noted. "In these cases, this approach might not achieve anything further. Those are the kinds of limitations that should be considered."

More information

For more on chemotherapy treatment, visit the American Cancer Society.