

Can Gut Microbes Save Patients from Chemotherapy Side Effects?

Intestinal microbes that survive chemo can rid the gut of excess chemo drugs and produce a vitamin that helps to stem nausea.

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Chemotherapy doesn't just kill cancer cells. It also affects the microbes in the digestive tract.

Researchers at UC San Francisco have discovered that some gut bacteria can reduce the side effects of these potent treatments, and that one family of cancer drugs may actually boost these protective bacteria.

The phenomenon could help physicians predict the severity of a patient's side effects and points the way to supplements that could help those whose guts aren't sufficiently protecting them.

"These studies emphasize the important relationship between the gut microbiome and drug toxicity," said [Peter Turnbaugh](#), PhD, a professor of microbiology and immunology at UCSF. "A more detailed understanding of this relationship could provide new strategies to optimize the treatment of cancer and other diseases."

Clearing drugs from the body

Turnbaugh's team found that colorectal cancer patients taking a class of cancer drugs known as fluoropyrimidines had much less diverse microbiomes in their digestive system. But the surviving bacteria did something amazing.

"They were able to gobble up the chemotherapy and chemically transform it into a harmless byproduct," said [Kai Trepka](#), a student in the Medical Scientist Training Program at UCSF who co-authored the study along with [Wesley Kidder](#), MD, MPH, an associate professor of medicine who specializes in gastrointestinal cancer. It published April 16 in [Science Translational Medicine](#).

The team also saw that measuring the abundance of helpful bacteria could predict whether a patient would develop the kind of severe side effects, like nausea or vomiting, that make it hard for people to complete their treatment.

When the researchers gave these drug-processing microbes to mice experiencing severe

chemotherapy side effects, their symptoms greatly improved, suggesting that humans may be able to use the bacteria as probiotics.

Clues to influencing the microbiome

A second study, published May 20 in the journal [mBio](#), revealed the microbiome can also protect patients from the painful numbness or tingling sensation that is another common side effect of chemotherapy, by producing vitamin K2.

When the researchers looked at the microbiomes of 56 colon cancer patients, they saw again that the fluoropyrimidine drugs had killed off some of the organisms and bolstered the populations of others.

Among those that thrived during chemotherapy was a nonpathogenic strain of *E. coli* that produced vitamin K2. The researchers gave K2 to mice who'd been treated with fluoropyrimidine drugs, and their neuropathy resolved.

Patients who reported fewer side effects also had more K2 in their microbiomes.

"For a long time, the microbiome has seemed like a black box," Kidder said. "We're now starting to be able to shine little flashlights and find clues to how we can influence it for the better — in this case, better outcomes for cancer patients."

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