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Scan Detects Oxygen Levels in Tumors

April 23, 2009 (HealthDay News) -- New research suggests that scientists are close to developing a simple way to measure oxygen levels in tumors, giving doctors a heads-up about what kind of treatment is best for individual patients.

The findings fit into an emerging trend of individualized treatment for patients with cancer instead of treating people the same way, said Dr. Mark Dewhirst, a professor of radiation oncology at Duke University Medical Center.

"If successful, [the trend] will revolutionize the way that we treat cancer," said Dewhirst, who co-wrote a commentary accompanying the new study, published April 22 in the *Journal of Clinical Investigation*.

Scientists began realizing the important role of oxygen in tumors about 50 years ago, said study co-author James Mitchell, branch chief of radiation biology at the U.S. National Cancer Institute's Center for Cancer Research. The scientists discovered that tumors with higher concentrations of oxygen were more susceptible to radiation, he said.

"Radiation damages cells by causing damage to DNA, and one particular type of damage renders the DNA molecule non-reparable," Mitchell said. But less oxygen in the tumor allows tumor cells to survive more easily by making the DNA destruction process more difficult, he said.

According to Dewhirst, the same is true for chemotherapy drugs, which also don't work as well when tumors have less oxygen.

Lower levels of oxygen create other problems, Dewhirst. "One would think at first that lack of oxygen would make tumors unhealthy and easy to kill," he said. "But actually, the opposite happens -- tumor cells that lack oxygen become more aggressive and more difficult to kill."

Tumors with lower oxygen levels even spread more easily through the body, he said.

Doctors can check oxygen levels in patients by inserting a needle. But doctors can't insert needles into some patients, and. in others, it's difficult to insert the needle deep enough, Mitchell said.

In the new study, the researchers tested a scanning technique called pulsed electron paramagnetic resonance imaging and used it in tandem with magnetic resonance imaging. The study authors said they were able to successfully measure oxygen levels in tumors in mice by using the non-invasive technology.

"The imaging that is described in this study provides all of the information necessary to evaluate oxygen levels in tumors as well as to examine underlying causes for the lack of oxygen," Dewhirst said. "The fact that all of the imaging is completely non-invasive provides the ability to perform this measurement more than once, (meaning) this could be used to monitor the effectiveness of cancer therapy."

There are caveats, however. The research hasn't reached the human testing level yet, and it may not work in people. "Scaling up the method to make it suitable for use in humans will be a significant challenge, but not impossible," Dewhirst said.

For now, the plan is to launch more studies with animals to see if the technique works as a way to test cancer drugs.

SOURCES: Mark W. Dewhirst, DVM, Ph.D., Gustavo S. Montana professor of radiation oncology and professor of pathology and biomedical engineering, Duke University Medical Center, Durham, N.C.; James Mitchell, Ph.D., branch chief, radiation biology, Center for Cancer Research, U.S. National Cancer Institute, Bethesda, Md.; April 22, 2008,*Journal of Clinical Investigation*