

Muscle wasting in cancer does not spare the heart

September 8 2010, by Emily Caldwell

The wasting disease associated with some cancers that is typically seen affecting skeletal muscles can also cause significant damage to the heart, new research in mice suggests.

Before now, cachexia, characterized by muscle wasting and dramatic weight loss, was believed to spare the heart. But an Ohio State University study showed that the condition reduces heart function and changes the [heart muscle](#) structure in mice with [colon cancer](#).

Previous studies have suggested that cachexia is responsible for between one-fifth and one-third of all cancer deaths. But many aspects of the condition remain misunderstood, including its cause and ways to predict who is at highest risk for the syndrome.

These new study findings could have immediate implications for treatment, said Martha Belury, lead author of the research and a professor of [human nutrition](#) at Ohio State.

"I think if we know certain types of cancer are associated with this wasting disease, it might be important to think about heart function earlier rather than once people are starting to lose weight. Clinicians could try to protect the heart while also giving patients chemotherapy for cancer and perhaps added nutrition to maintain weight," Belury said.

"The fatigue and weakness of cachexia have been attributed to skeletal muscle wasting. But our results support the idea that insufficient heart

performance might also be responsible for fatigue symptoms, leading to less exercise and more severe [muscle wasting](#). It's a vicious cycle that contributes to the complications of cancer cachexia."

The study is published in a recent issue of the *International Journal of Oncology*.

The researchers compared mice with and without colon cancer tumors. Colon cancer and other gastrointestinal tumors, as well as some lung cancers, are most commonly associated with development of cachexia

At day 14 of the study, when the mice with tumors were clearly losing weight, the scientists measured [cardiac function](#) in all of the mice using echocardiography, or an ultrasound of the heart. This evaluation showed that mice with tumors as a group had a heart rate of almost 21 percent fewer beats per minute on average and pumped significantly less blood than did the hearts of the healthy mice.

Three days later, the scientists observed a 23 percent difference in body weight between the mice with cancer and without tumors - a sign that the syndrome had clearly taken hold in the mice with cancer.

Though the mice with tumors ate less as the disease developed, the study was designed to show that food consumption wasn't the sole cause of weight loss. A group of healthy mice whose food consumption matched the lower consumption of the mice with cancer also lost weight, but retained their skeletal muscle mass and showed normal heart function.

The researchers examined the heart tissue of all of the mice using electron microscopy. They found a number of signs of damage in the heart muscle tissue of mice with cachexia, including an increase in fibrous tissue and changes in mitochondria, the so-called "powerhouses" in cells that convert carbon to energy.

"The mitochondria looked pretty bad, almost as if they were breaking apart. And we also saw evidence of the precursors of scarring, or collagen formation, which you don't want to see in any type of muscle and especially not in the heart muscle," Belury said.

No similar problems were seen in the hearts of mice without tumors.

By also examining gene function in the heart tissue, the researchers found that the proteins associated with power generation in muscle had converted from their adult form to a fetal type in the hearts of mice with cachexia. This phenomenon has been linked to heart failure in previous research.

"The heart was still trying very hard to maintain function and structure, so it was inducing this kind of action to try to heal itself but it just couldn't. There was too much going on for this to work," Belury said. "We wonder if we could harness some of this knowledge into a way of reversing the heart disease."

Future research could test whether using medication or added nutrition in early stages of cachexia might prevent [heart function](#) deterioration, she said.

Provided by The Ohio State University

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