MedicalXpress

Cancer from fetal exposure to carcinogens depends on dose, timing

December 15 2011

The cancer-causing potential of fetal exposure to carcinogens can vary substantially, a recent study suggests, causing different types of problems much later in life depending on the stage of pregnancy when the fetus is exposed.

The research sheds further light on the way in which toxic damage early in life can later manifest itself as cancer, due to "epigenetic" changes in cells. It was done by scientists in the Linus Pauling Institute at Oregon State University, and other institutions, in laboratory studies with mice.

In this study, published in the journal Cancer Letters, mice received four separate doses of a carcinogen commonly found in air pollutants or other combustion products. As a result, they had triple the level of ovarian cancer at the rodent equivalent of middle age. About 80 percent of them also got lung cancer, and many of the male mice had abnormally small testes – a phenomenon not seen before.

In previous research, by contrast, the same amount of this carcinogen given in a single dose had caused a much higher rate of T-cell lymphoma, a type of blood cancer, which this study found to almost disappear when the carcinogen exposure was spread out over time. Liver cancer also was largely absent.

"There's still a lot of uncertainty about how the fetus responds to carcinogens and at what points in time it is most vulnerable," said David Williams, a professor of environmental and molecular toxicology at

OSU.

"We know it's far more sensitive than adults for several reasons, including faster cell division and the lack of protective detoxifying enzymes," he said. "But it's interesting that the timing of fetal exposure makes such a difference in which organs are targeted. These results were somewhat surprising."

The mice in these experiments were exposed to one type of polycyclic aromatic hydrocarbon, a group of compounds commonly produced by everything from coal combustion to automobile exhaust. The levels of carcinogen the mice received were far higher than humans would face in a normal environment.

In the research, tracking with radioactive labeling showed that the carcinogens clearly made their way into the mouse fetuses, although at about 10 percent of the tissue concentration of those in the mother. The study was supported by the National Institutes of Health, and included collaborators from OSU and the Pacific Northwest National Laboratory.

Increasing amounts of research are being done on PAHs, which are associated with the burning of fossil fuels such as coal and petroleum, and may be on the rise in some areas, particularly China, Williams said. They can also get into soils, be taken up by plants and make their way into the human food chain.

The types of cancer that these carcinogens can cause in animal models include lymphoma and leukemia, and cancer is the number one cause of disease-related death in children. Epidemiological studies have shown that exposure of pregnant women to carcinogens such as cigarette smoke enhances the risk for offspring to develop a number of cancers.

"The fetal basis of adult disease is relevant to a number of chronic

diseases in humans, including diabetes, asthma, cardiovascular disease and cancer," the researchers wrote in their report, "as well as neurological and behavior toxicities."

Research such as this, scientists say, suggests that a healthy diet is important during pregnancy, including a wide range of fruits and vegetables. Cruciferous vegetables such as broccoli and cauliflower, in particular, have high levels of some compounds believed to help protect against cancer.

More information: Transplacental Carcinogenesis with Dibenzo[def,p]chrysene (DBC): Timing of Maternal Exposures Determines Target Tissue Response in Offspring, hdl.handle.net/1957/25641

Provided by Oregon State University