Air pollution linked to obesity, inflammation

Roughly one-third of the US population may be at an increased risk of developing health problems resulting from exposure to polluted air containing fine particulates. The tiny size of these pollutants allows them to travel deep into the lungs or other organs, potentially causing damage. In a new study, the specific effects of exposure to fine particulates on occurrence of inflammation, insulin resistance and obesity has been examined. These conditions are not only harmful themselves but are also risk factors for the development of type 2 diabetes.

In the study, young male C57BL/6 mice were exposed to polluted air containing ~111 μg per m^3 of fine particulate matter, a pollution level similar to those that can be found in urban areas of the US. Mice were exposed to the polluted air for 6 h per day, 5 days a week, for 10 weeks, beginning when they were 3 weeks old. This time frame roughly correlates with toddlerhood to late adolescence in humans.

Lee Pettet

Mice exposed to the polluted air experienced a greater accumulation of abdominal and subcutaneous fat, higher blood sugar levels, increased insulin resistance and higher levels of TNF-α, a molecule associated with inflammation, than did mice supplied with clean air (*Arterioscler. Thromb. Vasc. Biol.* **30**, 2518–2527; 2010). These results suggest that exposure to polluted air alone can induce metabolic dysfunction and contribute to obesity and proinflammatory conditions. In a press release, Sanjay Rajagopalan (The Ohio State University, Columbus), a leader of the research group, stated, "[t]hese findings suggest that fine particulate pollution exposure…may lead to an increase in fat cell size and number, and also have a proinflammatory effect."

Qinghua Sun, another study leader, added, "[t]his is one of the first, if not the first, study to show that these fine particulates directly cause inflammation and changes in fat cells, both of which increase the risk for type 2 diabetes."

It isn't known whether the effects of exposure to fine particulates are reversible or whether they are sustained during adult life, even if exposure ends. "In a real-world scenario, it would be very difficult to escape from the pervasive influence of dirty air, an influence that begins very early in life," said Sun.

The group has planned a human study that will take place in Beijing, China, in which the incidence of metabolic syndrome and insulin resistance will be tracked in participants wearing personal monitors to measure their exposure to pollution.

Monica Harrington

BRAIN TUMORS GROW THEIR OWN BLOOD VESSELS

Two recently published studies may help explain why glioblastoma, one of the most aggressive types of human cancer, is so difficult to treat. According to the studies, some glioblastoma cells can differentiate into endothelium cells, which line the interior of blood vessels, thereby forming vascular networks that help to feed the tumors.

Researchers have previously noted that glioblastoma tumors have extensive, abnormally structured blood vessels that consist of large, rapidly dividing cells. It was thought that these blood vessels were derived from normal brain vascular tissue, but no one had taken a close look, as Viviane Tabar, of Memorial Sloan-Kettering Cancer Center in New York, told *The Scientist*.

Tabar and colleagues first analyzed endothelial cells in glioblastoma samples for chromosomal abnormalities (*Nature* doi:10.1038/nature09624; published online 21 November 2010). They found that some of the endothelial cells within these samples had the same mutations as those found within the tumor cells. The team then used antibodies that stick to specific proteins to separate the glioblastoma cells. Further analyses showed that stem-like glioblastoma cells give rise to endothelium cells that constitute blood vessels. Tabar and her team injected these human cancer cells into the brains of immunodeficient mice. They found that the resulting tumor implants consisted of blood vessels of human origin, meaning that they were derived from the stem-like cancer cells.

In Italy, Ruggero De Maria of the Istituto Superiore di Sanità in Rome, Roberto Pallini of the Catholic University of Rome and colleagues were working on the same issue (*Nature* doi:10.1038/nature09557; published online 21 November 2010). They found that between 20% and 90% of endothelial cells in glioblastoma tumors were derived from the tumors. The team isolated the tumor cells that could become endothelial cells and injected these stem-like cells into immunodeficient mice. They found that the majority of the blood vessels in the resulting tumors were of human, instead of mouse, origin.

These studies might help to explain why a drug used to inhibit angiogenesis, or blood vessel growth, has limited effectiveness against glioblastoma. Further *in vitro* experiments carried out by Tabar's group showed that exposure to this drug inhibited maturation of tumor endothelial cells but was unable to inhibit the formation of blood vessels. On the other hand, exposure to an inhibitor of Notch signaling, which controls multiple cell differentiation processes, stopped the differentiation of the stem-like cancer cells into endothelial progenitors. Further research could possibly lead to the development of drugs that block this differentiation process.

Kirsten Dorans