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Photos of tiny blood vessels in the eye link air pollution to heart disease

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ANN ARBOR, Mich.---By digitally photographing the tiny, hair-like blood vessels in the back of our eyes, researchers can now look directly at how small blood vessels like those that bring blood to the heart respond to air pollution.

New digital photos of the retina revealed that otherwise healthy people exposed to high levels of air pollution had narrower retinal arterioles, an indication of a higher risk of heart disease.

Previous studies linked pollution to heart disease. The new study, published this week in *PLoS Medicine*, is the first known to examine relationships between pollution and extremely tiny blood vessels, called the microvasculature, in humans, said Sara Adar, research assistant professor at the University of Michigan School of Public Health. Adar did the work while an assistant professor at the University of Washington School of Public Health.

Researchers found that participants with short-term exposures to small amounts of pollution had the microvascular blood vessels of someone three years older, and people with long-term exposures to high pollution had the vessels of a person seven years older. Adar said that "such a change would translate to a 3 percent increase in heart disease for a woman living with high levels of air pollution as compared to a woman in a cleaner area."

Retinal vessels are an example of the very small vessels that exist in the

heart and throughout the body, but the ones in the eye are unique in that we can see them and take pictures of them and measure them directly in people without needing scalpels, probes, or anesthesia, said Dr. Joel Kaufman, professor of medicine and occupational and environmental health sciences at the University of Washington, Seattle, and senior author. "The fact that this study identified a relationship between microvascular width and air pollution exposures provides a strong potential link between the epidemiological observations of more cardiovascular events like fatal heart attacks with higher pollution exposures and a verifiable biological mechanism."

In the study, researchers took digital retinal photographs of blood vessels of participants aged 45-84 in the Multi-Ethnic Study of Atherosclerosis. They calculated the level of fine particulate matter in the air at each of the 4,607 participants' homes over the two years preceding the eye exam, and also used measured pollution levels on the day before the eye exam to calculate short-term exposure. Participants had no history of heart disease.

Even though pollution levels in the study were generally below the level that the EPA considers acceptable, these levels still appeared to negatively affect the tiny blood vessels, which are about the width of a human hair, Adar said. Though the vessels only narrow by about 1/100th the width of a human hair, this could have important health consequences if all of the microvasculature in the body is affected in the same way, she said.

In order to establish a causal relationship between air pollution and heart disease, scientists must demonstrate a plausible biological mechanism between exposure and heart disease, said Kaufman. This particular study provides compelling evidence in living people of the visible biological effect of air pollution in a pathway related to heart attack, stroke, or other vascular events.

Going forward, Adar said it's important to study the effects over time.

"Another exam, which is currently underway in these same people, will allow us to see if we can find changes in these vessel diameters over time as a function of air pollution," she said. "If we can, that will give us even more evidence that air pollution causes this vessel narrowing." Adar said that study could produce results in as little as two years.

More information: To see the paper: www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1000372

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