Researchers discover evidence that lead exposure in mothers can affect future generation

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A team of researchers at Wayne State University have discovered that mothers with high levels of lead in their blood not only affect the fetal cells of their unborn children, but also their grandchildren. Their study, Multigenerational epigenetic inheritance in humans: DNA methylation changes associated with maternal exposure to lead can be transmitted to the grandchildren, was published online this week in *Scientific Reports*.

It's a known fact that babies in the womb can be affected by low levels of lead exposure. If a pregnant woman is exposed to lead, the lead passes through the placenta into the baby's developing bones and other organs.

Pregnant women with a past exposure to lead can also affect the unborn child's brain, causing developmental problems later in life. Previous research studies have suggested that exposure to heavy metal toxicants can influence a person's global DNA methylation profile.

In the recent Wayne State study led by Douglas Ruden, Ph.D., professor in the Department of Obstetrics & Gynecology and the Institute of Environmental Health Sciences, director of epigenomics, and program leader in the Center for Urban Responses to Environmental Stressors, he and his research team revealed that lead exposure can cause specific changes in DNA methylation, which can be detected in dried blood spots beyond one generation. The neonatal blood spots from both the mothers and children in this study were obtained from the Michigan Neonatal Biobank, a unique resource that has most of the neonatal dried blood spots from children born in Michigan since 1984.

According to Ruden, epigenetic effects of environmental exposures beyond one generation have not yet been demonstrated in humans prior to this study. He and his team tested the hypothesis that human fetal germ cell exposure to environmental toxins causes epigenetic changes in the newborn blood from a grandchild of an exposed pregnant woman.

"Our results suggest that lead exposure during pregnancy affects the DNA methylation status of the fetal germ cells, which leads to altered DNA methylation in grandchildren's neonatal dried blood spots," said Ruden. "This is the first demonstration that an environmental exposure in pregnant mothers can have an epigenetic effect on the DNA methylation pattern in the grandchildren."

The research team stated that this novel, two-generational study design might be able to identify the genes that may serve as possible candidate biomarkers for future transgenerational risk assessment studies.

"Our pilot study provides indirect evidence that lead exposure in women during childbirth can affect the locus-specific DNA methylation status of grandchildren," said Ruden. "However, the altered DNA methylation profiles of the grandchildren's blood are apparently normalized during postnatal development. Also, fetal germline exposure to lead apparently has different epigenetic consequences than acute childhood exposure."

Provided by Wayne State University