Smoking during pregnancy linked to cerebral palsy, animal studies show

October 6 2017

Animal studies show that smoking during pregnancy can be linked to neurological disorders in offspring such as cerebral palsy. Credit: University of Technology, Sydney

Scientists investigating the underlying mechanism causing cell death and damage have confirmed links between maternal smoking and cerebral palsy, the most common physical disability in childhood.

When not enough blood and oxygen reach the developing brain the

resultant injury, known as a Hypoxia-ischemic injury (HII), reduces the wellbeing of the cellular 'powerhouse' mitochondria resulting in oxidative stress. This leads to increased cell death in the offspring's brain. Cerebral palsy is caused by increased cell death in several brain regions that regulate movement and memory retention. Approximately 34,000 people are living with cerebral palsy in Australia.

"By identifying the mechanism, we will be better able to identify potential preventative strategies and improve the neurological outcome in babies of smoking mothers," said Dr Hui Chen, University of Technology Sydney Senior Lecturer and lead researcher.

The researchers conclude that smokers should give up smoking well in advance of falling pregnant. "What we have observed so far is that in order to avoid harm to their baby, mothers need to give up smoking several months or even years before their pregnancy, as smoking will affect the quality of their eggs before they are even fertilised," said Dr Chen.

Dr Chen and her colleagues from the UNSW Sydney, Kolling Research Institute, the Woolcock Institute of Medical Research, the University of Sydney used mouse models to show that maternal smoking affects the functioning of mitochondrial cells responsible for powering the body's biological processes.

The research showed that mouse pups with high levels of oxidative stress in the brain are more likely to develop functional disorders. "We found that pups from smoking mothers are more clumsy at adolescent age, have less strength in their limbs, are more anxious, and have poor memory function which many affect their learning ability," said Dr Chen. In particular, the learning ability is worsened if the pups had hypoxic-ischemic injury.

"The increased oxidative stress is mainly because the mitochondria are unable to produce enough antioxidants to clear toxic chemicals called free radicals, causing harmful chemical build up in the brains of pups from the mothers exposed to cigarette smoke," said Dr Chen.

A potential preventative strategy may be to provide mothers with antioxidant supplementation during pregnancy. Previous studies carried out by this research team found the antioxidant L-carnitine given to pregnant mothers exposed to cigarette smoke can improve the health outcomes of kidneys and respiratory system in offspring.

"The next step will be to use such a treatment to improve functional outcomes in pups from the smoking mothers," said Dr Chen. "However, the message for the public is if you want a healthy baby, you need to stop smoking long before you plan for the pregnancy."

The results of the research are published in *Frontiers in Molecular Neuroscience*.

More information: Yik L. Chan et al. Maternal Cigarette Smoke Exposure Worsens Neurological Outcomes in Adolescent Offspring with Hypoxic-Ischemic Injury, *Frontiers in Molecular Neuroscience* (2017). DOI: 10.3389/fnmol.2017.00306

Provided by University of Technology, Sydney