Medical Xpress

Sewer-gas-induced suspended animation is rapid and reversible

March 25 2008

Low doses of the toxic gas responsible for the unpleasant odor of rotten eggs can safely and reversibly depress both metabolism and aspects of cardiovascular function in mice, producing a suspended-animation-like state. In the April 2008 issue of the journal *Anesthesiology*, Massachusetts General Hospital (MGH) reseachers report that effects seen in earlier studies of hydrogen sulfide do not depend on a reduction in body temperature and include a substantial decrease in heart rate without a drop in blood pressure.

“Hydrogen sulfide is the stinky gas that can kill workers who encounter it in sewers; but when adminstered to mice in small, controlled doses, within minutes it produces what appears to be totally reversible metabolic suppression,” says Warren Zapol, MD, chief of Anesthesia and Critical Care at MGH and senior author of the Anesthesiology study. “This is as close to instant suspended animation as you can get, and the preservation of cardiac contraction, blood pressure and organ perfusion is remarkable.”

Previous investigations into the effects of low-dose hydrogen sulfide showed that the gas could lower body temperature and metabolic rate and also improved survival of mice whose oxygen supply had been restricted. But since hypothermia itself cuts metabolic needs, it was unclear whether the reduced body temperature was responsible for the other observed effects. The current study was designed to investigate both that question and the effects of hydrogen sulfide inhalation on the cardiovascular system.

The researchers measured factors such as heart rate, blood pressure, body temperature, respiration and physical activity in normal mice exposed to low-dose (80 ppm) hydrogen sulfide for several hours. They analyzed cardiac function with electrocardiograms and echocardiography and measured blood gas levels. While some mice were studied at room temperature, others were kept in a warm environment – about 98º F – to prevent their body temperatures from dropping.

In all the mice, metabolic measurements such as consumption of oxygen and production of carbon dioxide dropped in as little as 10 minutes after they began inhaling hydrogen sulfide, remained low as long as the gas was administered, and returned to normal within 30 minutes of the resumption of a normal air supply. The animals' heart rate dropped nearly 50 percent during hydrogen sulfide adminstration, but there was no significant change in blood pressure or the strength of the heart beat. While respiration rate also decreased, there were no changes in blood oxygen levels, suggesting that vital organs were not at risk of oxygen starvation.

The mice kept at room temperature had the same drop in body temperature seen in earlier studies, but those in the warm environment maintained normal body temperatures. The same metabolic and cardiovascular changes were seen in both groups, indicating that they did not depend on the reduced body temperature, and analyzing the timing of those changes showed that metabolic reduction actually began before body temperature dropped.

"Producing a reversible hypometabolic state could allow organ function to be preserved when oxygen supply is limited, such as after a traumatic injury," says Gian Paolo Volpato, MD, MGH Anesthesiology research fellow and lead author of the study. "We don't know yet if these results will be transferable to humans, so our next step will be to study the use of hydrogen sulfide in larger mammals."

Zapol adds, “It could be that inhaled hydrogen sulfide will only be useful in small animals and we’ll need to use intravenous drugs that can deliver hydrogen sulfide to vital organs to prevent lung toxicity in larger animals.” Zapol is the Reginald Jenney Professor of Anaesthesia at Harvard Medical School.

Source: Massachusetts General Hospital

Citation: Sewer-gas-induced suspended animation is rapid and reversible (2008, March 25) retrieved 13 May 2024 from https://medicalxpress.com/news/2008-03-sewer-gas-induced-animation-rapid-reversible.html