Oxygen-deprived baby rats fare worse if kept warm

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New study suggests that baby rats deprived of oxygen, but kept warm, had bigger swings in glucose and insulin, metabolic and physiologic effects that could increase the chances of brain damage. Findings could have implications for premature infants, who often suffer from hypoxia.

Premature infants' immature lungs and frequent dips in blood pressure make them especially vulnerable to a condition called hypoxia in which their tissues don't receive enough oxygen, sometimes leading to permanent brain damage. New animal research suggests that a common practice in caring for these babies might in fact exacerbate this condition, increasing the chances for long-term neurological deficits. A new study shows that rat pups exposed to low oxygen for up to three hours, but kept warm, have changes in insulin and glucose regulation that lead to hypoglycemia. Those allowed to spontaneously cool, a natural response to decreased oxygen in the blood, kept their glucose and insulin values more stable over time. The findings suggest that cooling premature infants who have undergone oxygen deprivation, rather than placing them in incubators or under warmers, could help stave off brain damage associated with this condition.

The article is entitled "Effects of Body Temperature Maintenance of Glucose, Insulin, and Corticosterone Responses to Acute Hypoxia in the Neonatal Rat." It appears in the American Journal of Physiology – *Regulatory, Integrative, and Comparative Physiology*, published by the American Physiological Society.

The researchers worked with rats that were either two days old or eight days old. Since rats are born at an earlier developmental stage than humans, these ages were chosen to be analogous to critical periods of human neurological development when premature infants might be especially vulnerable to oxygen deprivation. Litters of pups of either age were separated into three groups: One breathed room air with normal levels of oxygen and was kept warm at normal body temperature with a heating pad; one was exposed to air with about a third of typical oxygen levels and allowed to spontaneously cool; and a third was exposed to low-oxygen air, but kept warm at normal body temperature. Over the course of a three-hour period, the researchers monitored the pups for levels of glucose, insulin, and other proteins and hormones in the bloodstream.

The researchers found that the younger pups exposed to hypoxia and heat had dramatic spikes and dips in insulin over the three-hour period, with insulin quadrupling over the first hour, then falling dramatically by the third. In the older animals, glucose rose over the first hour, then fell significantly below baseline by the third. Though hypoxia alone caused significant changes in glucose and insulin concentrations in both younger and older animals, these effects weren't as pronounced.

These findings suggest that keeping the animals warm may encourage swings in blood sugar that increase metabolic and physiologic demands and decrease the amount of glucose available to tissues. In rats, and perhaps in premature babies as well, this effect could lead to a variety of problems, including neurological damage. The authors note that, to their knowledge, there are no specific guidelines that address body temperature management for human premature babies with hypoxia. "We hope that our studies in the neonatal rat will translate to appropriate studies and guidelines for the control of body temperature in the hypoxic newborn," the authors say.

More information: The study is available online at bit.ly/ykfZu5