Medical Xpress

Study: Added oxygen during stroke reduces brain tissue damage

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Scientists have countered findings of previous clinical trials by showing that giving supplemental oxygen to animals during a stroke can reduce damage to brain tissue surrounding the clot.

The timing of the delivery of 100 percent oxygen - either by mask or in a hyperbaric chamber - is critical to achieving the benefit, however.

"The use of supplemental oxygen after blood flow is restored in the brain appears to actually cause harm by unleashing free radicals," said Savita Khanna, assistant professor of surgery at Ohio State University and principal investigator of the research. "The resulting tissue damage was worse than stroke-affected tissue that received no treatment at all."

Previous clinical trials in humans have suggested that administering oxygen under pressure could harm stroke patients. But the studies did not take into account the status of blood flow in the brain at the time the oxygen was delivered, Khanna noted.

The types of stroke under study are ischemic, meaning a clot is blocking blood flow in the brain, rather than hemorrhagic, strokes that occur when blood vessels rupture in the brain.

The new Ohio State study showed that the use of pure oxygen that was delivered by mask during stroke was also effective, making for easier clinical application of such a therapy when the time for that is right.

However, technology doesn't yet allow for quick and continuous real-time measurement of blood flow in the brain in a hospital. This means clinicians treating stroke patients cannot risk administering hyperbaric oxygen that could do more harm than good if it is not timed properly.

"Hyperbaric oxygen during stroke shows the promise of being an effective tool, but there are things that need to occur before this can be applied in a clinical setting," said Cameron Rink, assistant professor of surgery at Ohio State and a co-investigator on the research. "We need to find better ways to monitor blood flow in humans in real time."

Rink presented the research Monday (10/19) during a poster session at the Society for Neuroscience annual meeting in Chicago.

Stroke is the third-leading cause of death in the United States, and an effective treatment remains elusive. So-called "clot-busting" drugs dissolve the clots, but typically must be administered within three hours of the stroke's onset. The average time between the start of a stroke and a patient's arrival at a hospital is about four hours - which adds to the treatment challenge, according to the researchers.

Khanna, Rink and colleagues tested the effects of supplemental oxygen therapy on five groups of rats in which the scientists induced a 90-minute ischemic stroke and then restored blood flow in the animals' brains.

Two groups of animals received either normal oxygen or pressurized oxygen while blood flow was blocked in the brain. Two other sets of rats received normal or pressurized oxygen after blood flow was restored. A control group received no supplemental oxygen, breathing room air instead.

Two days later, the researchers examined the rats' brains using powerful

4.7-Tesla magnetic resonance imaging to calculate the volume of damaged tissue. The images showed the size of the infarct, or the area of tissue susceptible to stroke damage as a result of poor oxygenation.

The images showed that the animals that received supplemental oxygen treatment while blood flow was blocked had a significantly smaller amount of tissue damage compared to the rats that received oxygen after blood flow was restored, Khanna said.

By further examining images of the rats' brains, the scientists determined that the supplemental oxygen during the active period of a stroke specifically reduced the death of neurons and prevented the damage that free radicals can cause to lipids that help protect those brain cells. By comparison, more dead neurons and oxidative stress were found in the brains of rats receiving oxygen only after blood flow was restored.

"Ultimately, the supplemental oxygen after blood flow is restored is more than the tissue can handle, and is more than it needs. Why add oxygen on top of tissue that's already oxygenated?" Rink said. "Supplemental oxygen during the blockage, on the other hand, is highly protective."

The researchers are using other technologies to determine how the loss of oxygen affects the functions of genes in the brain. Of the approximately 30,000 genes investigated to date, at least 6,000 are either inactivated or highly activated when a stroke reduces the oxygen in the brain. Their future work will explore the ramifications of those changed gene functions.

Source: The Ohio State University (news : web)