Severe heart attack damage limited by hydrogen sulfide

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Administering hydrogen sulfide (H_2S) directly into the heart during a simulated heart attack significantly reduces the tissue and cell damage often seen in oxygen-starved organs, according to a new study from researchers at the University of Alabama at Birmingham.

H_2S boosts post-heart-attack function by helping to minimize reperfusion injury, an unwanted side effect of restoring blood flow swiftly to hearts suffering from low oxygen, the study authors said.

In testing on mice, the H_2S injection led to a 72 percent reduction in the amount of severe heart-tissue death after restoring normal oxygen and blood flow to mice hearts. The 72 percent reduction compares to a much larger average amount of tissue death in un-treated mice hearts after the same 30 minutes of oxygen deprivation.

Findings on the protective qualities of H_2S have broad implications for improving human survival after cardiac arrest, heart transplant and trauma in general, said David Kraus, Ph.D., a UAB associate professor in the Departments of Environmental Health Sciences and Biology and co-author on the new study.

“One of the most damaging biological stresses on the heart and other organs from trauma or transplantation is the rapid change in oxygen levels,” Kraus said. “First there’s a drop, which elicits a dramatic cellular adjustment to survive low oxygen, and then a rapid rise caused by resuscitation.

"H_2S as an internal bodily signal appears to serve as an important protective mechanism during the stress of low oxygen availability," he said.

The study was published Sept. 18 in the online Early Edition of the journal *Proceedings of the National Academy of Sciences*. The UAB researchers worked with a team led by David Lefer, Ph.D. from the Albert Einstein College of Medicine in Bronx, N.Y.

The tests were done by injecting H_2S directly into the hearts of mice who had been anesthetized for surgery, and whose left ventricular artery had been clamped for 30 minutes to simulate a heart attack.

In addition to a decrease in heart-tissue death, H_2S-treated mice hearts showed a 35 percent drop in blood-protein levels that signal myocardial damage, and a 26 percent drop in heart-tissue markers of inflammation when compared to un-treated mice hearts.

Furthermore, by isolating mitochondria from the H_2S-treated mice, the authors confirmed that heart-cell functional integrity had been preserved. Recent reports from other researchers demonstrate that inhaled H_2S can induce a fully reversible "suspended animation" state in animals.

Kraus said it follows that H_2S could be used to place organs into "suspended animation" before surgery or during medical transport until normal oxygen and blood flow is restored. Also, by augmenting internal H_2S production in the body, perhaps through diet, people may reduce their risks of cardiovascular disease, chronic oxidative cell damage and other illnesses, Kraus said.

H_2S is normally considered a toxic, flammable gas that is responsible for the foul odor of rotten eggs. But in the UAB study it was carefully

formulated into a low concentration saline-type solution.

Source: University of Alabama at Birmingham