Bench-to-bedside review: Hydrogen sulfide – the third gaseous transmitter: applications for critical care

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Bench-to-bedside review: Hydrogen sulfide – the third gaseous transmitter: applications for critical care

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Hydrogen sulfide (H2S), a gas with the characteristic odor of rotten eggs, is known for its toxicity and as an environmental hazard, inhibition of mitochondrial respiration resulting from blockade of cytochrome c oxidase being the main toxic mechanism. Recently, however, H2S has been recognized as a signaling molecule of the cardiovascular, inflammatory and nervous systems, and therefore, alongside nitric oxide and carbon monoxide, is referred to as the third endogenous gaseous transmitter. Inhalation of gaseous H2S as well as administration of inhibitors of its endogenous production and compounds that donate H2S have been studied in various models of shock. Based on the concept that multiorgan failure secondary to shock, inflammation and sepsis may represent an adaptive hypometabolic response to preserve ATP homoeostasis, particular interest has focused on the induction of a hibernation-like suspended animation with H2S. It must be underscored that currently only a limited number of data are available from clinically relevant large animal models. Moreover, several crucial issues warrant further investigation before the clinical application of this concept. First, the impact of hypothermia for any H2S-related organ protection remains a matter of debate. Second, similar to the friend and foe character of nitric oxide, no definitive conclusions can be made as to whether H2S exerts proinflammatory or anti-inflammatory properties. Finally, in addition to the question of dosing and timing (for example, bolus administration versus continuous intravenous infusion), the preferred route of H2S administration remains to be settled—that is, inhaling gaseous H2S versus intra-venous administration of injectable H2S preparations or H2S donors. To date, therefore, while H2S-induced suspended animation in humans may still be referred to as science fiction, there is ample promising preclinical data that this approach is a fascinating new therapeutic perspective for the management of shock states that merits further investigation.

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