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Effects of sodium hydrogen sulfide (a H2S donor) on acute kidney injury

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Implication for health policy/practice/research/medical education:
Hydrogen sulfide plays an important role in renal pathology and shows the protective role under pathological conditions in some of experimental models of renal disease.

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Editorial

Hydrogen sulfide (H2S), third endogenous gaseous transmitter, is enzymatically synthesized through β-synthase (CBS), cystathionine γ-lyase (CSE), cystathionine, and 3-mercaptopyruvate sulfurtransferase (3-MST) in tissues of mammalians. These enzymes are in the kidney and account for the production of endogenous renal H2S (1). H2S has a critical role in physiology and pathology of the kidney (2,3). The H2S physiological level causes vasodilation and enhances the rate of glomerular filtration and blood flow of kidney, causing an indirect rise of the K+ and Na+ urinary excretion (1). H2S shows the protective role under pathological conditions in some of the experimental kidney injury, such as chronic and acute renal diseases (1). Acute kidney injury is a disorder known with quick lack of renal function. That is described as the clinical symptom of many diseases which acutely influence renal (4). Now we will describe the effect of the H2S effects on three of the acute renal failure.

Renal ischemia/reperfusion injury

Renal IRI is the main reason for acute renal failure. The pathological mechanism affecting renal IRI is so complicated including calcium overload, production of ROS, ATP depletion, and inflammatory and apoptotic reactions (5). The endogenous H2S effect on renal IRI has been shown in different studies. Particularly, mRNA and protein levels of CBS and CSE decreased in IRI accompanied with the decline of level of H2S in plasma and kidney (6) however mechanisms affecting IRI which brought about CBS and CSE decline are not still known. Also, inhibition of CBS or CSE via their pharmacological inhibitors increases renal injury severely (6,7) showing that the IRI can result from the diminished endogenous H2S generation. The concept is approved in a study that defect of CSE is correlated with elevated kidney injury and fatality after renal IRI because of the increased generation of ROS (3). Then, the exogenous H2S influence was widely studied in different renal ischemia/reperfusion injury (8). In many studies, NaHS as an H2S donor was used and showed protective impact probably via anti-apoptotic, anti-inflammatory, and anti-oxidative reactions (3,6).

Obstructive nephropathy

Obstructive nephropathy, as one of kidney damages,

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is induced by blockage of the urogenital system. After ureteral obstruction, fibrosis of kidney is assumed in developing obstructive nephropathy (9). Ureteral obstruction was reported to impair endogenous generation of H2S by decreasing the CBS expression level. Renal fibrosis decreases whenever exogenous H2S is given showing an inhibitory impact of H2S on fibrosis of renal. NaHS can prevent the proliferation of cell and obstruct the differentiation into myofibroblasts in cultured kidney fibroblast through inhibiting TGFβ1-Smad and mitogen-activated protein kinase signaling pathways (2). NaHS administration also arrests the disorders of renal function via ureteral blockage (2, 10). A recent study showed which H2S release slowly donor GYY4137 alleviated inflammatory damage, tubulointerstitial fibrosis and cortical loss in an experimental model of obstructive nephropathy (11). Overall, these findings show showed H2S donor is a treatment for obstructive nephropathy.

Cisplatin nephrotoxicity

Cisplatin is a crucial curative medicine for some of tumors, causing intense renal toxicity (12, 13). More than thirty percent of patients consuming cisplatin with high dose suffer dysfunction of kidney. Nevertheless, influential cure of renal dysfunction induced by cisplatin is not available yet. Studies have revealed that inflammatory response and oxidative stress are the main factors stimulants for nephrotoxicity induced by cisplatin (14). Considering the inhibitory impacts of H2S on inflammation and oxidative stress (6), H2S is assumed as a protection versus nephrotoxicity induced by cisplatin. But, H2S plays a conflicting role because of controversial data. It was shown which cisplatin upregulated expression of CSE after 72 hours via cisplatin treatment in an in vivo study (15). Whenever DL-Propargylglycine (PAG) was given with cisplatin, PAG terminated the CSE up-regulation, and rescued nephrotoxicity caused by cisplatin via inhibiting apoptosis and inflammation (15). In contrast, NaHS administration recovers the renal dysfunction and damage in rats which treated with cisplatin (13, 16). CSE and CBS levels were found greatly declined due to cisplatin therapy in mice after 3 days (16). Despite the hopeful protective impact of H2S, it may not be assumed protective in cisplatin renal toxicity. Researches are required to study further the effect of endogenous H2S using genetic mice rather than non-specific CBS/CSE suppressors, the variation of CSE and expression level of CBS in a period of time-dependent method, the impact of exogenous H2S using various H2S (NaHS, GYY4137, AP39) donors in equivalent.

Conclusion

In conclusion, due to the considerable impact of H2S in renal physiology, H2S defective may contribute to the kidney pathogenesis-related disorders. Treatment of H2S by NaHS was found to save renal injuries in different kinds of experimental kidney disorders. Drugs of H2S donors should be examined to deliver H2S as a cure for kidney disturbances. Also, studies in molecular level are required to improve our perception of the H2S impact on renal pathophysiology.

Conflicts of interest

The author declared no competing interests.

Author's contribution

EM is the single author of the manuscript.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the author.

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References

1. Wu D, Luo N, Wang L, Zhao Z, Bu H, Xu G, et al. Hydrogen sulfide ameliorates chronic renal failure in rats by inhibiting apoptosis and inflammation through ROS/MAPK and NF-κB signaling pathways. Sci Rep. 2017;7(1):455. doi: 10.1038/s41598-017-00557-2.
2. Song K, Wang F, Li Q, Shi YB, Zheng HF, Peng H. et al. Hydrogen sulfide inhibits the renal fibrosis of obstructive nephropathy. Kidney Int. 2014;85 (6):1318–29. doi: 10.1038/ki.2013.449.
3. Bos EM, Wang R, Snijder PM, Boersema M, Damman J, Fu M, et al. Cystathionine γ-lyase protects against renal ischemia/reperfusion by modulating oxidative stress. J Am Soc Nephrol. 2013;24(5):759–70. doi: 10.1681/ASN.2012030268.
4. . Bellomo R, Kellum JA, Ronco, C. Acute kidney injury. Lancet. 2012;380(9843):756–66. doi: 10.1016/S0140-6736(11)61454-2.
5. Eltzschig HK, EckleT. Ischemia and reperfusion [mdash] from mechanism to translation. Nat Med. 2011; 17(11): 1391–401. doi: 10.1038/nm.2507.
6. Cao X, Bian JS. The role of hydrogen sulfide in renal system. Front Pharmacol. 2016;7:385. doi: 10.3389/fphar.2016.00385.
7. Tripatara P, Patel NS, Collino M, Gallicchio M, Kieswich J, Castiglia S, etal. Generation of endogenous hydrogen sulfide by cystathionine gamma- lyase limits renal ischemia/reperfusion injury and dysfunction. Lab Invest. 2008;88(10):1038–48. doi: 10.1038/labinvest.2008.73.

8. Ahmad A, Olah G, Szczesny B, Wood ME, Whiteman M, Szabo C. AP39, A mitochondrially targeted hydrogen sulfide donor, exerts protective effects in renal epithelial cells subjected to oxidative stress in vitro and in acute renal injury in vivo. Shock. 2016:45(1):88–97. doi: 10.1097/SHK.0000000000000478.
9. Boor P, Ostendorf T, Floege J. Renal fibrosis: novel insights into mechanisms and therapeutic targets. Nat Rev Nephrol. 2010;6(11):643-56. doi: 10.1038/nrneph.2010.120.
10. Dursun M, Otunctemur A, Ozbek E, Sahin S, Besiroglu H, Ozsoy OD, et al. Protective effect of hydrogen sulfide on renal injury in the experimental unilateral ureteral obstruction. Int Braz J Urol. 2015;41(6):1185–93. doi: 10.1590/S1677-5538.IBJU.2014.0090.
11. Lin S, Visram F, Liu W, Haig A, Jiang J, Mok A, et al. GYY4137, a slow-releasing hydrogen sulfide donor, ameliorates renal damage associated with chronic obstructive uropathy. J Urol. 2016;196(6):1778-87. doi: 10.1016/j.juro.2016.05.029.
12. Pezeshki Z, Khosravi A, Nekuei M, Khoshnood S, Zandi E, Eslamian M, Talebi A, Emami SN, Nematbakhsh M. Time course of cisplatin-induced nephrotoxicity and hepatotoxicity. J Nephropathol. 2017;6(3):163-7. doi: 10.15171/jnp.2017.28.
13. Karimi A, Absalan F, Khorsandi L, Valizadeh A, Mansouri E. Sodium hydrogen sulfide (NaHS) ameliorates alterations caused by cisplatin in filtration slit diaphragm and podocyte cytoskeletal in rat kidneys. J Nephropathol. 2017;6(3):150-56. doi:10.15171/jnp.2017.26
14. Peres LAB, da Cunha AD, Jr. Acute nephrotoxicity of cisplatin: molecular mechanisms. J Bras Nefrol. 2013;35(4):332-40. doi: 10.5935/0101-2800.20130052.
15. Della Coletta Francescato H, Cunha FQ, Costa RS, Barbosa Junior F, Boim MA, Arnoni CP, et al. Inhibition of hydrogen sulphide formation reduces cisplatin-induced renal damage. Nephrol Dial Transplant. 2011;26(2):479-88. doi: 10.1093/ndt/gfq447.
16. Liu M, Jia Z, Sun Y, Zhang A, Yang T. A H 2 S donor GYY4137 exacerbates cisplatin-induced nephrotoxicity in mice. Mediators Inflamm.2016:8145785. doi: 10.1155/2016/8145785.