$PM_{2.5}$ induced declined cardiac tolerance to ischemia reperfusion injury can be ameliorated by Hydrogen sulphide

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Early studies have documented that $PM_{2.5}$ can not only induce cardiac tissue toxicity, but it can adversely affect the performance of the myocardium and deteriorate the tolerance to withstand Ischemia reperfusion injury (IR). The primary factor that contributes to the adverse impacts of $PM_{2.5}$ exposure on the heart is subcellular changes, with particular emphasis on mitochondrial dysfunction, inflammation, oxidative stress, and deterioration of pro-survival signaling pathways. Despite the ongoing efforts to uncover the mechanistic changes induced by $PM_{2.5}$ exposure on the heart, no studies have presented strategies for mitigating $PM_{2.5}$-induced cardiotoxicity or enhancing the tolerance of the myocardium to withstand IR injury. Considering the potential of hydrogen sulphide, the gasotransmitter known to protect the heart from pathologies linked to oxidative stress and mitochondrial dysfunction, we explored the efficacy of H2S in attenuating $PM_{2.5}$ associated increased IR injury. Female Wistar rats were exposed to 250 $\mu g/m^3$ of $PM_{2.5}$ for 3hrs daily for 21 days after which the hearts were isolated and mounted on isolated rat heart apparatus. H2S was administered directly to the $PM_{2.5}$ exposed hearts after which the hearts were subjected to 30min of ischemia and 60min of reperfusion to induce IR injury. Our results revealed that the ability of the $PM_{2.5}$ exposed myocardium to withstand IR injury had considerably improved. The pivotal mechanism driving these beneficial changes was the preservation of mitochondrial function (improved bioenergetics, respiration) along with the quality controls mechanisms. The improvement in mitochondrial function was also reflected in terms of reduced oxidative stress and activation of pro-survival signalling pathways as well. Based on these findings we concluded that hydrogen sulphide holds promise as a potential therapeutic agent for enhancing the myocardium's resilience to additional stressors in the form of IR.