Expression of manganese superoxide dismutase in rat blood, heart and brain during induced systemic hypoxia

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Abstrak

Latar belakang: Hipoksia mengakibatkan peningkatan ROS. Hingga saat ini, belum banyak diketahui mengenai peran MnSOD ? enzim antioksidan endogen utama ? pada respons adaptasi sel terhadap hipoksia. Penelitian ini bertujuan menganalisis ekspresi mRNA dan aktivitas spesifi k MnSOD pada darah, jantung dan otak tikus yang diinduksi hipoksia sistemik.

Metode: 25 ekor tikus Sprague Dawley diinduksi hipoksia sistemik di dalam ruang hipoksia (8-10% O2) selama 0, 1, 7, 14 atau 21 hari. Ekspresi relatif mRNA MnSOD dianalisis menggunakan Real Time RT-PCR. Aktivitas spesifi k MnSOD diukur dengan metode inhibisi xantin oksidase.

Hasil: Ekspresi relatif mRNA MnSOD pada darah dan jantung tikus menurun selama fase awal induksi hipoksia sistemik (hari ke 1) dan meningkat setelah hari ke 7, sedangkan ekspresi mRNA pada otak meningkat sejak hari ke 1 dan mencapai kadar maksimum pada hari ke 7. Hasil pengukuran aktivitas spesifi k MnSOD selama awal induksi hipoksia sistemik menyerupai hasil ekspresi mRNA. Pada kondisi hipoksia yang sangat lanjut (hari ke 21), aktivitas spesifi k MnSOD pada darah, jantung dan otak menurun secara signifi kan. Ekspresi mRNA MnSOD pada ketiga jaringan tersebut selama hari ke 0-14 induksi hipoksia sistemik berkorelasi positif dengan aktivitas spesifi knya. Selain itu, ekspresi mRNA dan aktivitas spesifi k MnSOD pada jantung berkorelasi kuat dengan hasil pada darah.

Kesimpulan: Ekspresi MnSOD pada fase awal dan lanjut induksi hipoksia sistemik mengalami regulasi yang berbeda. Ekspresi MnSOD pada otak berbeda dengan pada darah dan jantung, menunjukkan bahwa jaringan otak dapat lebih bertahan pada induksi hipoksia sistemik dibandingkan jantung dan darah. Pengukuran ekspresi MnSOD di dalam darah dapat digunakan untuk menggambarkan ekspresinya di dalam jantung pada keadaan hipoksia sistemik.
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Abstract
Background: Hypoxia results in an increased generation of ROS. Until now, little is known about the role of MnSOD - a major endogenous antioxidant enzyme - on the cell adaptation response against hypoxia. The aim of this study was to determine the MnSOD mRNA expression and levels of specifi c activity in blood, heart and brain of rats during induced systemic hypoxia.

Methods: Twenty-five male Sprague Dawley rats were subjected to systemic hypoxia in an hypoxic chamber (at 8-10% O2) for 0, 1, 7, 14 and 21 days, respectively. The mRNA relative expression of MnSOD was analyzed using Real Time RT-PCR. MnSOD specifi c activity was determined using xanthine oxidase inhibition assay.

Results: The MnSOD mRNA relative expression in rat blood and heart was decreased during early induced systemic hypoxia (day 1) and increased as hypoxia continued, whereas the mRNA expression in brain was increased since day 1 and reached its maximum level at day 7. The result of MnSOD specifi c activity during early systemic hypoxia was similar to the mRNA expression. Under very late hypoxic condition (day 21), MnSOD specifi c activity in blood, heart and brain was signifi cantly decreased. We demonstrate a positive correlation between MnSOD mRNA expression and specifi c activity in these 3 tissues during day 0-14 of induced systemic hypoxia. Furthermore, mRNA expression and specifi c activity levels in heart strongly correlate with those in blood.

Conclusion: The MnSOD expression at early and late phases of induced systemic hypoxia is distinctly regulated. The MnSOD expression in brain differs from that in blood and heart revealing that brain tissue can possibly survive better from induced systemic hypoxia than heart and blood. The determination of MnSOD expression in blood can be used to describe its expression in heart under systemic hypoxic condition.