

补阳还五汤对中风大鼠脑组织中ROS生成的抑制作用

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诱发脑中风的分子机理至今尚未清楚，临床研究表明经典验方补阳还五汤治疗脑中风作用显著，但其作用的分子机理也不清楚。运用低温电子顺磁共振（EPR）技术和自旋捕捉EPR技术实验研究了中风大鼠脑组织中ROS的生成情况；并首次直接测定了补阳还五汤对中风大鼠皮层及小脑的活性氧物质（ROS），包括一氧化氮生成的影响。同时还检测了补阳还五汤对体外化学模拟体系产生的超氧阴离子（ $O_2^{\cdot-}$ ）和羟自由基（ $\cdot OH$ ）的清除能力。结果表明，与对照组相比，中风大鼠皮层及小脑中的ROS生成明显增多（ $P < 0.05$ ），脑组织中的NO水平也明显升高（ $P < 0.001$ ）；补阳还五汤可明显（ $P < 0.05$ ）抑制中风大鼠皮层及小脑中ROS的生成，显著降低NO水平（ $P < 0.05$ ，与中风不给药组比较）；补阳还五汤对于体外化学模拟反应生成的 $O_2^{\cdot-}$ 和 $\cdot OH$ 也有很强的清除能力。由此可认为ROS的生成是导致脑中风的重要分子机理之一，而抑制ROS的生成则可能是补阳还五汤抗脑中风作用的途径之一，同时也说明在中药现代化研究中EPR技术可作为一种有效的研究工具。

INHIBITORY EFFECTS OF BYHWD ON ROS GENERATION IN STROKE RAT BRAIN TISSUES

The molecular mechanism leading to stroke remains unclear until now. A number of clinic researches demonstrate that Buyang Huanwu decoction (BYHWD), a traditional Chinese medicine (TCM) recipe, has a significant curative effect on brain stroke. However, the molecular mechanism of BYHWD's pharmacological effect is not clear too. In this study, cryogenic electron paramagnetic resonance (EPR) and spin trapping techniques were used to detect the generation of reactive oxygen species (ROS) in stroke rat brain. They were also used to evaluate the inhibitory effect of BYHWD on the generation of ROS (including nitric oxide) in the stroke brain tissues, on $O_2^{\cdot-}$ and $\cdot OH$ free radicals in chemical mimic system in vitro as well. The results show that there is a significant increase of ROS generation in stroke rat brain tissues. This increase can be suppressed by BYHWD. Besides, BYHWD has a great scavenge potency on $O_2^{\cdot-}$ and $\cdot OH$ free radicals in chemical mimic system in vitro. These findings suggest that the increase of ROS generation may be an important factor that induces the stroke. Furthermore, the inhibition on ROS may dictate the underlying mechanism regulated by BYHWD. They also suggest that EPR technique can be used to explore the pharmacological mechanism of TCM recipe, which is of significance to the modernization of TCM recipe.

关键词

活性氧物质 (ROS); 脑中风 (Stroke); 电子顺磁共振 (Electron paramagnetic resonance); 补阳还五汤 (Buyang Huanwu decoction)