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快速眼球转动期睡眠剥夺对大鼠学习、记忆能力及其海马组织脑源性神经营养因子表达的影响

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摘要:

目的:观察快速眼球转动期睡眠剥夺(RSD)及恢复睡眠(RS)对大鼠海马脑源性神经营养因子(BDNF)表达及学习、记忆能力的影响.方法:大鼠分为空白对照组、环境对照组、RSD 1 d组、RSD 3 d组、RSD 5 d组、RSD 7 d组以及RSD 7 d后RS6 h、RS 12 h组,每组12只;RSD大鼠模型采用改良多平台法建立.Y-型迷宫试验评定各组大鼠学习、记忆能力;实时定量RT-PCR及免疫组化方法检测各组大鼠海马区BDNF mRNA及蛋白表达水平.结果:Y-型迷宫评定结果表明RSD各组以及RS 6 h、12 h组错误反应次数明显高于空白对照组和环境对照组($P<0.05$);与空白对照组相比,RSD 1 d、3 d大鼠总反应时间降低($P<0.05$),RSD 7 d组明显增加($P<0.05$).与空白对照组相比,RSD 1 d组大鼠海马BDNF mRNA表达明显上升($P<0.05$),RSD 3 d组达到高峰($P<0.01$).RSD 1 d、3 d组海马CA1、CA3、齿状回区以及RSD 5 d、RS 6 h组齿状回区BDNF蛋白表达显著高于空白对照组($P<0.05$).结论:睡眠剥夺会导致机体学习、记忆能力下降,RS后可部分改善;机体可能会通过促进BDNF表达来代偿相对较短时间的睡眠剥夺,保护自身的认知能力,然而随着剥夺时间的延长,这种代偿机制也会被打破.

关键词: 睡眠剥夺 脑源性神经营养因子 海马 学习 记忆

Effects of rapid eye movement sleep deprivation on cognitive function and expression of brain-derived neurotrophic factor in rat hippocampus

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Abstract:

Objective: To investigate the effects of various degrees of rapid eye movement (REM) sleep deprivation (RSD) and sleep recovery on cognitive function (learning and memory) and expression of brain-derived neurotrophic factor (BDNF) in the rat hippocampus. Methods, Male SD rats were divided into 8 groups (n= 12): blank control group (with normal sleep), environmental control, RSD 1 d, RSD 3 d, RSD 5 d, RSD 7 d, recover sleep 6 h after 7 d RSD (RS 6 h), and recover sleep 12 h after 7 d RSD (RS 12 h). The modified multiple platform method (MMPM) was used to establish sleep deprivation model in rats. The cognitive functions of rats were tested by Y-type maze. The hippocampal BDNF mRNA and protein levels were detected by real-time PCR and immunohistochemical method. Results: The failure reaction times of all RSD groups and the 2 RS groups were significantly more than those in control group and environmental control group ($P<0.05$). Compared with the control group, the total reaction time in RSD 1 d, 3 d groups was significantly lower ($P<0.05$), but that of RSD7 d group was significantly higher ($P<0.05$). Compared with the blank control group, expression of BDNF mRNA was significantly increased in RSD 1 d group ($P<0.05$), and reached the peak in RSD 3 d group. The protein expression of BDNF in CA1, CA3, and denatae gyrus areas of RSD1 d, 3 d groups and in the denatae gyrus area of RSD5 d and RS6 h groups was significantly higher than that of blank control group ($P<0.05$). Conclusion: Short-time RSD can lead to decrease of learning and memory ability, and recovery of sleep can partially improve their ability. The increase of BDNF expression may compensate the result of sleep deprivation and protect the cognitive function. However, as the prolongation of deprivation time, the compensation may become invalid

Keywords: sleep deprivation hippocampus brain-derived neurotrophic factor learning memory

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