

论著

胰岛素降低海马谷氨酸和D-丝氨酸含量改善糖尿病大鼠空间学习记忆能力

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摘要 目的 观察胰岛素对糖尿病(DM)大鼠空间学习记忆及海马组织中谷氨酸和D-丝氨酸含量的影响。方法 采用尾静脉注射链脲佐菌素(STZ)制备大鼠DM模型。注射STZ第3天建模成功后,大鼠sc给予胰岛素 $2\text{ U}\cdot\text{kg}^{-1}$,每天1次,持续82 d。定期检测各组大鼠体质量及空腹血糖。第81天进行Morris水迷宫实验,检测大鼠学习记忆能力;实验结束后取海马组织,观察形态变化,并测定谷氨酸和D-丝氨酸含量。结果 与正常对照组比较,DM模型组大鼠体质量明显减轻($P<0.01$),血糖明显升高($P<0.01$),逃避潜伏期明显延长,原平台象限游泳时间显著减少($P<0.01$),海马组织中谷氨酸及D-丝氨酸的含量均显著升高($P<0.01$)。胰岛素治疗组体质量增加,血糖含量恢复到正常水平。与DM模型组相比,胰岛素治疗组大鼠逃避潜伏期显著缩短($P<0.01$),原平台象限游泳时间占总时间百分比显著增加($P<0.01$);海马组织中谷氨酸和D-丝氨酸的含量也分别由DM模型组的(1.550 ± 0.054)和(0.084 ± 0.05) $\text{mg}\cdot\text{g}^{-1}$ 下降为胰岛素治疗组的(1.137 ± 0.023)和(0.068 ± 0.004) $\text{mg}\cdot\text{g}^{-1}$ 。结论 胰岛素可以改善糖尿病大鼠空间学习记忆能力,这可能与降低海马组织中谷氨酸和D-丝氨酸含量有关。

关键词 糖尿病 学习记忆 海马 谷氨酸 D-丝氨酸

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Improvement of insulin on learning and memory impairment by decreasing content of glutamate and D-serine in hippocampus of diabetic rats

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Abstract

OBJECTIVE To investigate the effect of insulin on learning and memory abilities of rats with diabetes mellitus(DM) and its mechanism. **METHODS** Diabetes was induced by a single intravenous injection of streptozotocin (STZ). The insulin treatment began 3 d after STZ injection. The rats in insulin group were given subcutaneous injection of insulin about $2\text{ U}\cdot\text{kg}^{-1}$ per day for 82 d, respectively. The body mass and serum glucose were measured at the defined time. On the 81st day, all groups were tested in Morris water maze to detect spatial learning and memory abilities. After that, all rats were sacrificed and the hippocampus was harvested. HE staining was performed to observe the changes of microstructure in the hippocampus. The content of glutamate (Glu) and D-serine was determined by high performance liquid chromatography. **RESULTS** Compared with normal control group, the body mass in DM group decreased ($P<0.01$), the blood glucose increased ($P<0.01$), the escape latency to reach the platform increased ($P<0.01$), and the percentage of time spent in target quadrant significantly decreased ($P<0.01$). The content of Glu and D-serine in the hippocampus of DM model group was significantly higher than those in normal control group. Compared with DM model group, the blood glucose in insulin group returned to normal, the body mass increased, the latency decreased ($P<0.01$) and the percentage of time

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spent in the target quadrant increased ($P < 0.01$). The content of Glu and *D*-serine in insulin group decreased from (1.550 ± 0.054) and $(0.084 \pm 0.050) \text{mg} \cdot \text{g}^{-1}$ wet tissue in DM model group to $(1.137 \pm$