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运动训练对大鼠损伤远端脊髓超微结构及脑源性神经营养因子表达的影响

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摘要：

摘要目的：明确运动训练对大鼠脊髓损伤（SCI）后远端脊髓超微结构及脑源性神经营养因子（BDNF）表达的影响。方法：成年雌性SD大鼠18只，采用改良Allen撞击法制作T9不完全性SCI模型。术后随机分为损伤后1周组、对照组（未行训练）及训练组（术后1周开始训练，共4周）。分别在损伤前、损伤后第1、2、3、4及5周时采用BBB评分评定运动功能，训练结束后取腰膨大段脊髓进行电镜观察超微结构，免疫组化检测BDNF蛋白表达情况。结果：①BBB评分：对照组与训练组BBB评分均较损伤后1周、2周明显提高，但训练组较对照组增加更为显著（P<0.05）。②超微结构：损伤后1周组，髓鞘排列规律整齐、轴索较均匀一致、核仁清晰；对照组髓鞘松散、轴索与髓鞘间出现空隙、轴突变性及空泡；训练组髓鞘完整、较薄、轴索均匀、髓鞘下及神经纤维周围基质中少见空泡。③BDNF免疫组化：BDNF免疫反应阳性产物多分布于脊髓前角，中央管周围也有出现，背角少见；训练组BDNF阳性染色颗粒增多，平均光密度值较损伤后1周组及对照组均显著增加（P<0.05）。结论：运动训练能减轻损伤远端脊髓继发性损害，并促进BDNF蛋白的表达。

关键词：脊髓损伤 超微结构 脑源性神经营养因子 运动训练

The effect of exercise training on ultrastructure and brain-derived neurotrophic factor expression in spinal cord distal to injury level in rats

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Abstract:

Abstract Objective: To determine the effects of exercise training on ultrastructure and brain-derived neurotrophic factor(BDNF) expression in spinal cord distal to injury level in rats. Method: Eighteen female adult Sprague-Dawley rats were included to make incomplete spinal cord injury（SCI） at T9 level by using modified Allen's method. Those rats were divided randomly into 1 week post injury group, control group(without training) and exercise group (trained by body-weight-support-treadmill-training, started from 1 week after injury, lasted 10 min/time, twice a day, 5d/week, for 4 weeks). Locomotor function was evaluated using Basso-Beattic-Bresnahan (BBB) scale before injury and at the 1st, 2nd, 3rd, 4th and 5th week post-injury. Ultrastructure changes and expression of BDNF were detected by electron microscope and immunohistochemistry test respectively. Result: ①BBB scores in exercise and control groups were higher than that at 1 week and 2 week post injury, but BBB scores in exercise group increased more significantly than that in control group (P<0.05). ②Ultrastructure changes in control group, the most notable changes were the overt splitting of myelin lamellae, evident loss of myelin compaction and much intramyelinic vacuoles. In exercise group, axons retained their round or oval shapes, but there were few intramyelinic vacuoles and some loss of myelin compaction. ③In immunohistochemistry test positive immunologic reaction to BDNF protein was mainly located in anterior horn of spinal cord, the expression level in exercise group increased remarkably compared with 1 week post injury group and control group (P<0.05). Conclusion: Exercise training may alleviate the secondary degeneration and enhance the expression of BDNF in spinal cord distal to injury level in rats.

Keywords:spinal cord injury ultrastructure brain-derived neurotrophic factor exercise training

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