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# 基于不同力学微环境大鼠骨折愈合模型建立及对局部CGRP受体表达的影响

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# Effects of biomechanical environment on fracture healing and on the expression of CGRP receptor of callus in rats

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摘要 目的 通过建立不同力学微环境大鼠股骨干骨折模型,评价力学对骨折愈合的影响并观察不同力学环境对骨折局部CGRP受体表达的影响。方法 将104只SD大鼠随机分为两组,细钉组和粗钉组分别采用直径0.8 mm和1.0 mm的髓内钉固定。造模后第1、2、5和8周处死实验动物,通过X线评分、Micro-CT技术、生物力学技术、组织学技术评价两组不同时间点骨折愈合情况,利用免疫组织化学检测、RT-PCR检测以及Western blot检测,评价不同力学环境下骨痂组织中CGRP受体的mRNA和蛋白表达。结果 X线评分显示,术后各个时间点两组的差异均无统计学意义。Micro-CT结果显示第2周时两组TV值均较前增大,细钉组TV值高于粗钉组,而粗钉组BV及BV/TV值高于细钉组,差异均有统计学意义;第5周时两组TV值达到最大,细钉组TV值仍高于粗钉组,而粗钉组的BV值及BV/TV值高于细钉组,差异均有统计学意义;第8周时两组TV值均较第5周时减小,BV及BV/TV值仍继续增加,但两组的差异无统计学意义。生物力学评价结果显示,第1、5、8周时两组的力学性能差异无统计学意义,仅第2周时粗钉组的最大载荷、抗弯刚度及最大断裂能均高于细钉组。CGRP受体免疫组化检测结果显示仅造模后第1、2周细钉组阳性表达高于粗钉组。Western blot结果显示随时间延长骨痂组织中CGRP受体的蛋白表达量逐渐下降,但造模后第1、2周时,细钉组的表达水平高于粗钉组。RT-PCR结果显示,仅造模后第1、2周细钉组的CGRP受体 mRNA表达水平高于粗钉组。结论 不同直径髓内钉大鼠股骨干闭合骨折模型可模拟不同程度微动的力学环境,骨折愈合早期较大的微动有利于CGRP受体的蛋白与mRNA表达,力学环境可能通过影响CGRP受体的表达水平调节骨折的愈合过程。

关键词: 骨折愈合 受体, 降钙素基因相关肽 生物力学 模型,动物

Abstract: Objective The aim of the present study was to evaluate the express of CGRP receptor based on the stability of biomechanical environments. Methods Femoral shaft fractures were created in 104 rats, which were treated with intramedully nails of 0.8mm diameter or 1.0mm diameter. Rats were then sacrificed at 1, 2, 5 or 8 weeks. Fracture healing was analyzed using X -ray, Micro-CT, histological and biomechanical methods. The express of CGRP receptor was evaluated by immunohistochemistry, Western blot and RT-PCR. Results The X-ray showed that there was not significant between the two groups at any time points. At 2 weeks, TV was significantly greater in the thin nail group than the thick nail group. However, BV, BV/TV and biomechanical testing of the thick nail group was significantly superior to the thin nail group. At 5 weeks, TV was also significantly greater in the thin nail group than the thick nail group. BV and BV/TV was significantly greater in the thick nail group than the thin nail group. At 8 weeks, there was no significant difference between the two groups in BV, TV, BV/TV or biomechanical testing. At 1 and 2 weeks, the mRNA and protein expression of CGRP receptor in thin nail group was statistically significant than in the thick nail group. However, there was no significance in mRNA and protein expression of CGRP receptor between the thin and thick group in 5 and 8 weeks. Conclusion Biomechanical environment in callus might have an effect on the expression of CGRP receptor. In the early phase of fracture healing, instability leads to more expression of CGRP receptor than in the stable condition. CGRP signaling may target the early phase of fracture healing.

Key words: Fracture healing Receptors, calcitonin gene-related peptide Biomechanics Models, animal

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