

# 伤科黄水对兔牵拉成骨区新骨生成的影响

蔡立雄<sup>1</sup>, 杨海韵<sup>1</sup>, 孙丙银<sup>2</sup>, 温建强<sup>1</sup>, 吴峰<sup>1</sup>, 吴玢<sup>2</sup>, 严加取<sup>1</sup>

(1. 广东省佛山市中医院, 广东 佛山 528000; 2. 广州中医药大学, 广东 广州 510006)

**摘要 目的:**探讨伤科黄水对兔牵拉成骨区新骨生成的影响及作用机制。**方法:**对 24 只新西兰白兔左侧股骨进行牵拉成骨手术, 手术成功后将所有兔子随机分为 2 组, 每组 12 只。实验组手术切口处及克氏针针孔处外敷伤科黄水纱布, 对照组切口处及克氏针针孔处外敷酒精纱布。术后通过肉眼观察、血液学检查及 X 线检查, 比较 2 组动物的切口和新骨生成情况。**结果:**①肉眼观察。术后 3 d, 实验组动物手术切口表面及克氏针针孔处色红、干燥、少许结痂、肌肉组织轻度肿胀; 术后 5 d, 切口表面干燥, 远端克氏针针孔处肤色淡红; 术后 7 d, 切口处有大量皮毛生长, 切口已愈合, 针孔处无感染迹象; 术后 10 d, 切口完全愈合, 皮毛生长接近正常。术后 3 d, 对照组动物切口色红、较湿润, 远端有少许渗液, 针孔处未见渗液, 肌肉组织明显肿胀; 术后 5 d, 切口皮肤色红、轻度湿润、肿胀, 有少许结痂及皮毛生长; 术后 7 d, 远端针孔处有少许渗液, 肌肉组织轻度肿胀, 有中等量皮毛生长; 术后 10 d, 切口结痂愈合, 无明显肿胀, 表面干燥, 有中等量皮毛生长。实验组动物比对照组创面愈合快 $[(7.5 \pm 0.6) \text{ d}, (8.3 \pm 1.2) \text{ d}, t = -2.066, P = 0.025]$ 。②血液学检查。术后 5 d, 实验组肿瘤坏死因子  $\alpha$  含量和碱性成纤维细胞生长因子含量均高于对照组 $[(2.3 \pm 0.8) \text{ ng} \cdot \text{mL}^{-1}, (1.8 \pm 0.5) \text{ ng} \cdot \text{mL}^{-1}, t = 1.836, P = 0.040; (125.2 \pm 4.6) \text{ ng} \cdot \text{L}^{-1}, (121.3 \pm 3.8) \text{ ng} \cdot \text{L}^{-1}, t = 2.264, P = 0.017]$ ; 术后 7 d, 实验组白细胞计数、中心粒细胞计数和百分比、淋巴细胞计数和百分比均低于对照组 $[(7.3 \pm 0.3) \text{ 个} \cdot \text{mL}^{-1}, (8.7 \pm 1.7) \text{ 个} \cdot \text{mL}^{-1}, t = -2.809, P = 0.001; (4.0 \pm 0.9) \text{ 个} \cdot \text{mL}^{-1}, (5.1 \pm 1.6) \text{ 个} \cdot \text{mL}^{-1}, t = 2.076, P = 0.025; (54.8 \pm 1.7) \%, (57.1 \pm 3.9) \%, t = -1.873, P = 0.037; (2.5 \pm 0.5) \text{ 个} \cdot \text{mL}^{-1}, (3.1 \pm 0.9) \text{ 个} \cdot \text{mL}^{-1}, t = 2.019, P = 0.028; (23.8 \pm 1.6) \%, (25.3 \pm 1.4) \%, t = 2.444, P = 0.011]$ 。③X 线检查。术后 4 周时的 X 线片示, 2 组动物牵拉成骨区均可见灰色低密度影, 有大量新骨形成, 骨皮质尚未连续; 实验组牵拉成骨区骨小梁密度、数量明显多于对照组, 骨痂生长情况也优于对照组。**结论:**伤科黄水能促进兔牵拉成骨区新骨生成, 其机制可能是伤科黄水改善了手术部位的软组织条件。

**关键词** 骨生成, 牵张 伤科黄水 动物实验

**Effect of the traumatology yellow water on new bone formation of distraction osteogenesis zone in rabbit** Cai Lixiong\*, Yang Haiyun, Sun Bingyin, Wen Jianqiang, Wu Feng, Wu Bin, Yan Jiaqu. \* Foshan Hospital of Traditional Chinese Medicine, Foshan 528000, Guangdong, China

**ABSTRACT Objective:** To explore the effect and its mechanism of action of the traumatology yellow water on new bone formation of distraction osteogenesis (DO) zone in rabbit. **Methods:** Twenty-four New Zealand white rabbits were obtained for DO surgery in the left femurs, after the surgery all the rabbits enrolled in the study were randomly divided into 2 groups, 12 cases in each group. The traumatology yellow water gauze (experimental group) and alcohol gauze (control group) were applied to the surgical incisions and Kirschner wires pinholes of rabbits. After the surgery, the rabbits were compared between the 2 groups in incisions and new bone formation by the means of macroscopic observation, hematological examination and X-ray examination. **Results:** Three days after surgery, the surgical incisions and Kirschner wires pinholes of the rabbits in experimental group showed red, dry, a little callus and mild swelling. Five days after surgery, the incision surface were dry and the color of skin around distal Kirschner wires pinholes were reddish. Seven days after surgery, a lot of newborn fur were found around the incisions and the incisions had healed up and there was no evidence of infection in pinholes. Ten days after surgery, the incisions healed completely and the growth of fur approach normal. Three days after surgery, the surgical incisions of the rabbits in control group were red and wet and there was a few seepage in the distal end of incisions. No seepage was found in pinholes and obvious swelling was found in muscular tissue. Five days after surgery, the incisions skin were red, mild wet and swollen and a little callus and fur were found around it. Seven days after surgery, there were a few seepage in distal pinholes and the muscular tissue was mild swollen and the amount of fur was moderate. Ten days after surgery, the incisions healed without obvious swelling, The surface of incision was dry and moderate amount of fur

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通讯作者: 杨海韵 E-mail: 13809210960@139.com

was found around the incision. The incisions healing time of rabbits in experimental group was shorter than that of the control group ( $7.5 \pm 0.6$  vs  $8.3 \pm 1.2$  days,  $t = -2.066$ ,  $P = 0.025$ ). Five days after surgery, the content of tumor necrosis factor- $\alpha$  and basic fibroblast growth factor of experimental group were higher than those of control group ( $2.3 \pm 0.8$  vs  $1.8 \pm 0.5$  ng/ml,  $t = 1.836$ ,  $P = 0.040$ ;  $125.2 \pm 4.6$  vs  $121.3 \pm 3.8$  ng/l,  $t = 2.264$ ,  $P = 0.017$ ). Seven days after surgery, the white blood cell count, neutrophils count and percentage, lymphocyte count and percentage of the experimental group were lower than those of control group ( $7.3 \pm 0.3$  vs  $8.7 \pm 1.7$  cell/ml,  $t = -2.809$ ,  $P = 0.001$ ;  $4.0 \pm 0.9$  vs  $5.1 \pm 1.6$  cell/ml,  $t = 2.076$ ,  $P = 0.025$ ;  $54.8 \pm 1.7$  vs  $57.1 \pm 3.9\%$ ,  $t = -1.873$ ,  $P = 0.037$ ;  $2.5 \pm 0.5$  vs  $3.1 \pm 0.9$  cell/ml,  $t = 2.019$ ,  $P = 0.028$ ;  $23.8 \pm 1.6$  vs  $25.3 \pm 1.4\%$ ,  $t = 2.444$ ,  $P = 0.011$ ). Four weeks after surgery the X-ray film showed that the gray low density shadow could be found in DO zone in the 2 groups, moreover, there were a lot of newborn bone and the cortical bone was discontinuous. The density and amount of the bone trabecula in DO zone of experimental group were significantly more than those of the control group, and also the same to bony callus growth. **Conclusion:** The traumatology yellow water can promote the new bone formation in DO zone of rabbits, probably for that it can improve the soft tissue condition around the operative site.

**Key words** Osteogenesis, distraction; The traumatology yellow water; Animal experimentation

伤科黄水是佛山市中医院院内制剂,在治疗骨折早期肿胀疼痛、开放或闭合软组织损伤及促进创面愈合等方面临床效果显著。2013 年 10 月至 2014 年 1 月,我们进行了伤科黄水对家兔牵拉成骨(distraction osteogenesis, DO)区新骨生成影响的实验研究,现总结报告如下。

## 1 材料与仪器

**1.1 实验动物** 2~3 月龄健康新西兰白兔 24 只,雌雄不限,体质量 2.0~2.2 kg,购自广州中医药大学动物实验中心,实验动物合格证号:粤监证字 2013A005SYXK(粤)2013-0003。实验获得广州中医药大学实验动物伦理委员会批准。

**1.2 实验试剂** 注射用青霉素钠(河南新乡华星药厂,国药准字 H41020817);75% 酒精[北京贞玉民生药业有限公司,京卫消备字(2006)第 0001 号];伤科黄水,药物组成包括黄连 120 g、黄芩 100 g、栀子 120 g、黄柏 100 g、紫草 60 g、白矾 10 g、苦参 150 g、虎杖 90 g、薄荷 30 g、冰片 10 g 等,规格为每瓶 500 mL,生药含量  $0.138 \text{ g} \cdot \text{mL}^{-1}$ (佛山市中医院,粤制药字 Z20070924)。

**1.3 实验仪器** 自行研制的兔股骨牵张器<sup>[1]</sup>;钛质克氏针(石家庄市达邦医疗器材厂);DR2200 X 线摄片机(深圳市蓝韵实业有限公司);BC-3000 全自动血液细胞分析仪(武汉福尔泰科技发展有限公司)。

## 2 方法

**2.1 手术操作** 按照文献[1]的方法在所有实验动物左侧股骨截骨,并安装股骨牵张器。

**2.2 药物干预** 手术成功后将 24 只新西兰白兔随

机分为 2 组,每组 12 只。实验组手术切口处及克氏针针孔处外敷伤科黄水纱布,对照组切口处及克氏针针孔处外敷酒精纱布。2 组动物每天上午 9:00 同时换药,每次 5 mL,每天 1 次。从术后第 6 天开始牵拉,每天 2 次,每次 0.5 mm,共牵拉 10 d,牵拉长度 10 mm。

**2.3 实验观察** 术后通过肉眼观察、血液学检查及 X 线检查,比较 2 组动物的切口和新骨生成情况。肉眼观察主要观察动物手术切口和克氏针针孔的愈合情况;血液学检查指标包括白细胞计数、中心粒细胞计数和百分比、淋巴细胞计数和百分比、肿瘤坏死因子  $\alpha$  (Tumor necrosis factor- $\alpha$ , TNF- $\alpha$ ) 含量及碱性成纤维细胞生长因子(basic fibroblast growth factor, bFGF)含量,其中白细胞计数、中心粒细胞技术和百分比、淋巴细胞技术和百分比测定采用 BC-3000 全自动血液细胞分析仪, TNF- $\alpha$  含量测定采用放射免疫法, bFGF 含量测定采用酶联免疫吸附法。

**2.4 统计学处理** 采用 SPSS19.0 软件进行统计分析,2 组动物创面愈合时间及血液学检查结果的组间比较采用  $t$  检验,检验水准  $\alpha = 0.05$ 。

## 3 结果

**3.1 肉眼观察** 实验组动物切口长约 4 cm,术后以伤科黄水纱布覆盖切口和克氏针针孔处[图 1(1),图 1(2)];术后 3 d,手术切口表面及克氏针针孔处色红、干燥、少许结痂、肌肉组织轻度肿胀[图 1(3)];术后 5 d,切口表面干燥,远端克氏针针孔处肤色淡红[图 1(4)];术后 7 d,切口处有大量皮毛生长,切口已愈合,针孔处无感染迹象[图 1(5)];术后 10 d,切口完全愈合,皮毛生长接近正常[图 1(6)]。对照组动

物切口长约 4 cm,术后以酒精纱布覆盖切口和克氏针针孔处[图 2(1),图 2(2)];术后 3 d,切口色红、较湿润,远端有少许渗液,针孔处未见渗液,肌肉组织明显肿胀[图 2(3)];术后 5 d,切口皮肤色红、轻度湿润、肿胀,有少许结痂及皮毛生长[图 2(4)];术后 7 d,远

端针孔处有少许渗液,肌肉组织轻度肿胀,有中等量皮毛生长[图 2(5)];术后 10 d,切口结痂愈合,无明显肿胀,表面干燥,有中等量皮毛生长[图 2(6)]。实验组动物比对照组创面愈合快[(7.5 ± 0.6) d, (8.3 ± 1.2) d,  $t = -2.066$ ,  $P = 0.025$ ]。

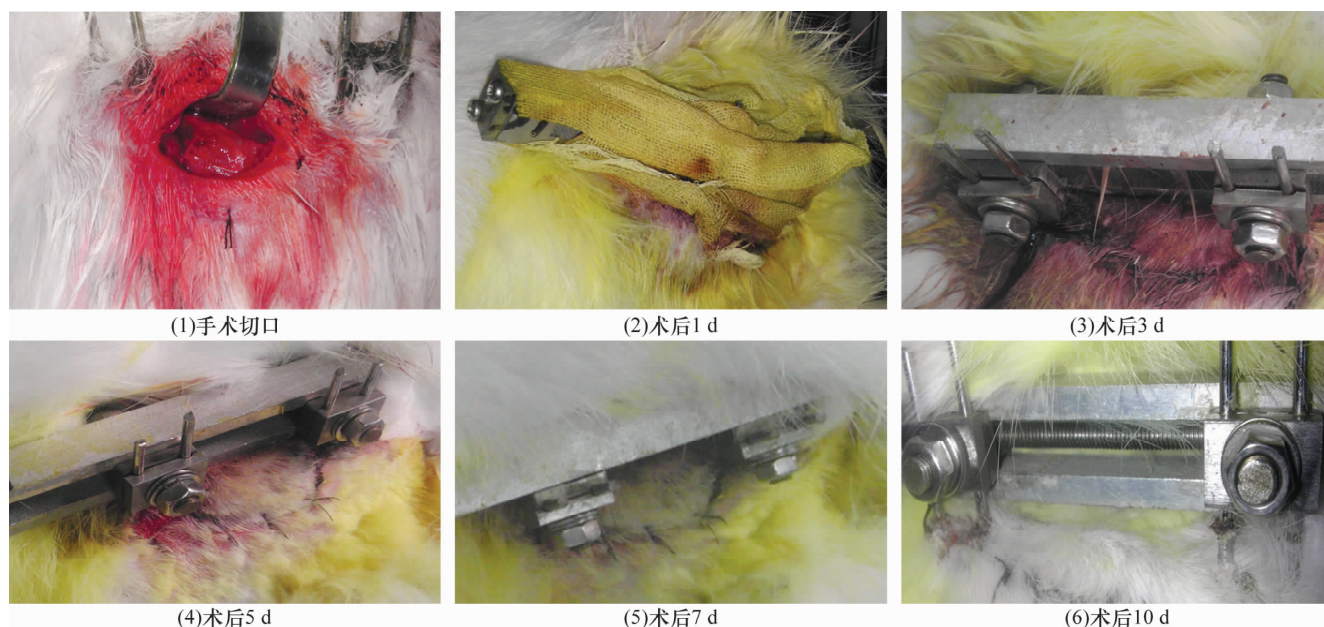


图 1 实验组家兔 DO 术后切口外观

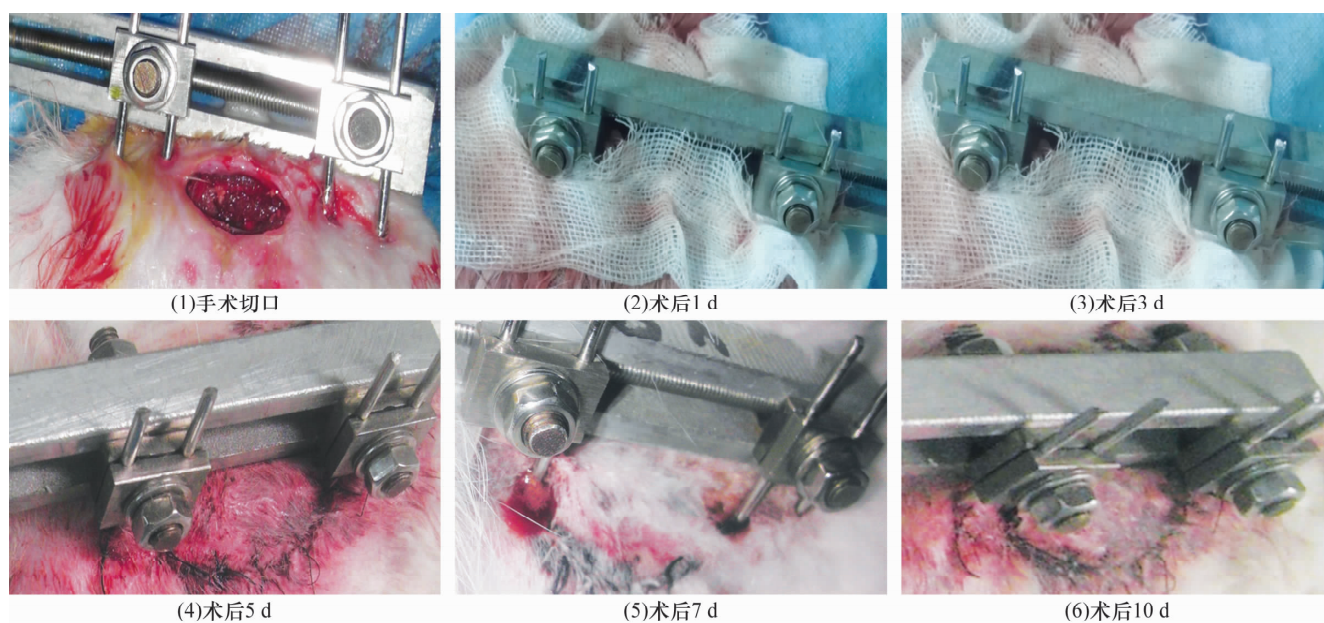


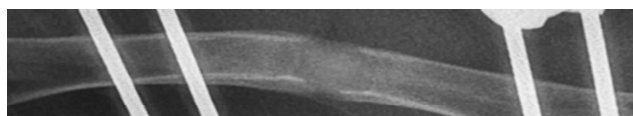
图 2 对照组家兔 DO 术后切口外观

**3.2 血液学检查** 术后 5 d,实验组 TNF- $\alpha$  含量和 bFGF 含量均高于对照组;术后 7 d,实验组白细胞计数、中心粒细胞计数和百分比、淋巴细胞计数和百分比均低于对照组(表 1)。

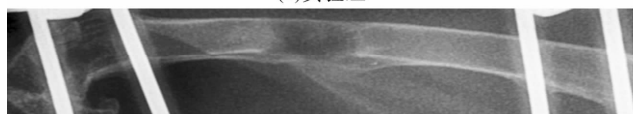
**3.3 X 线检查** 术后 4 周时的 X 线片示,2 组动物 DO 区均可见灰色低密度影,有大量新骨形成,骨皮质尚未连续;实验组 DO 区骨小梁密度、数量明显多于对照组,骨痂生长情况也优于对照组(图 3)。

表 1 2 组家兔 DO 术后血液学检查结果

组别	TNF- $\alpha$ (ng · mL <sup>-1</sup> )	bFGF (ng · L <sup>-1</sup> )	白细胞计数 (个 · mL <sup>-1</sup> )	中性粒细胞 计数(个 · mL <sup>-1</sup> )	中性粒细胞 百分比	淋巴细胞计数 (个 · mL <sup>-1</sup> )	淋巴细胞 百分比
实验组	2.3 ± 0.8	125.2 ± 4.6	7.3 ± 0.3	4.0 ± 0.9	(54.8 ± 1.7)%	2.5 ± 0.5	(23.8 ± 1.6)%
对照组	1.8 ± 0.5	121.3 ± 3.8	8.7 ± 1.7	5.1 ± 1.6	(57.1 ± 3.9)%	3.1 ± 0.9	(25.3 ± 1.4)%
<i>t</i> 值	1.836	2.264	-2.809	2.076	-1.873	2.019	2.444
<i>P</i> 值	0.040	0.017	0.001	0.025	0.037	0.028	0.011



(1)实验组



(2)对照组

图 3 2 组家兔术后 4 周 DO 区 X 线片

## 4 讨 论

DO 是骨质截骨后,通过安装外固定装置,对截骨端进行持续、缓慢地牵拉,刺激骨形成、达到治疗骨骼畸形或缺损的外科技术<sup>[2]</sup>。该技术不仅可刺激骨质再生,神经、血管、肌肉、皮肤、黏膜、骨膜等组织也会同时伴随牵拉而再生。良好的软组织环境,可加速成骨并提高成骨质量。当 DO 区局部血管的再生受到干扰时,氧张力降低,致使牵拉间隙内形成软骨,即使有纤维组织形成,但排列疏散、骨小梁数量过少,并会通过软骨内成骨的方式形成新骨,最终导致 DO 新骨形成周期延长<sup>[3]</sup>。

伤科黄水中的黄连、黄芩能清热解毒、燥湿泻火,现代药理研究证实二者具有抗菌、消炎、镇痛的作用<sup>[4]</sup>;栀子具有凉血止血、清热解毒、消肿止痛和促进软组织愈合的作用;黄柏能泻火解毒,行血止血,且能促进毛细血管再生;紫草能清营解毒、凉血活血,同时也被证实具有抗菌、抗炎的作用<sup>[5]</sup>;白矾具有解毒杀虫、收涩止痒及抗菌的作用<sup>[6]</sup>;苦参清热燥湿,虎杖活血定痛,二者合用具抗菌、抗病毒的作用<sup>[7]</sup>;薄荷能透疹解毒、疏肝解郁,同时也具有消炎、镇痛作用<sup>[8]</sup>;冰片可通诸窍、散郁火,去翳明目,消肿止痛。诸药合用,具有清热解毒、利水燥湿、凉血止血、活血消肿、化瘀定痛、祛腐生肌的功效,从而使炎性细胞早期浸润,迅速减少炎性物质渗出,消除组织细胞水肿,增加成纤维细胞和新生毛细血管,提高 TNF- $\alpha$  与 bFGF 水平,改善创面微循环,加快创面结痂与修复,加速伤口愈合<sup>[9-10]</sup>。之前的研究已证实,伤科黄水不仅能降低血液黏稠度,改善微循环与组织缺氧状态,加快血肿

吸收,而且具有广谱的抗菌消炎作用,如对金黄色葡萄球菌所致的小鼠皮肤化脓性感染有明显治疗作用,对表皮葡萄球菌和乙型溶血性链球菌引起的感染也具有很好的治疗作用<sup>[11-12]</sup>。

本研究的结果提示,伤科黄水能促进兔 DO 区新骨生成,其机制可能是伤科黄水改善了手术部位的软组织条件。

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