

## 实验研究

## 在创面愈合中毛细血管通透性的动态研究——“偎脓长肉”作用机制研究之一

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**摘要:**采用改良 Saba 毛细血管通透性实验法,研究外用中药“偎脓长肉”促进创面愈合机制。实验结果表明:外用中药可增强创面局部毛细血管通透性。在创面愈合中期外用中药组与对照组局部荧光物浓度呈显著性差异( $P < 0.05$ )。而血浆荧光物清除率和尿中排出率与对照组比较无显著性差异( $P > 0.05$ )。提示外用中药不影响全身毛细血管通透性,而对局部毛细血管通透性有明显的调节作用。

**关键词:**毛细血管通透性 外用中药 创面愈合。

“偎脓长肉”是指外用中药能促使创面分泌大量粘稠性的分泌物,在创面愈合中期,此种脓液量越多,则创面愈合越快<sup>[1]</sup>。本实验采用静脉注入荧光素钠标准颗粒<sup>[2]</sup>,测定家兔血、尿以及伤口局部渗出物的荧光浓度。综观伤口愈合中毛细血管通透性的全身和局部动态变化规律,并以光镜及电镜观察创面毛细血管的显微结构及超微结构,提出外用中药对毛细血管通透性改变的形态学基础。探讨“偎脓长肉”脓液来源与毛细血管通透性的相关性。

## 材料与方 法

1. 材料:(1)纯种大耳白家兔,体重 1.5~1.75kg,雌雄各半(天津动物实验中心)。(2)荧光素 Na(上海试剂三厂)。(3)外用中药生肌膏、玉红膏、黄连膏。(4)金黄色葡萄球菌(全国质控标准菌株)15 亿/ml。(5)紫外分光光度计(日本岛津——240)。

## 2. 方法:

(1)感染创面模型:经脱毛后用 2% 普鲁卡因作局部麻醉,在家兔后背部作一圆型切口,直径为 4cm,去除表皮、真皮和皮下的结缔组织,深至肌层。用无菌空塑料(直径 4cm,高 0.5cm)固定于伤口,与边缘皮肤缝合,填入 15 亿/ml 金黄色葡萄球菌 1ml 浸渍的直径为 4cm 圆型纱布,包扎伤口。48 小时换药,手术后第

4、7、14、21 天各组分别取样测定。

(2)局部毛细血管通透性实验:实验随机分成 4 组,每组家兔 12 只。分别换药。①对照组,在无菌条件下换凡士林油纱;②生肌膏组;③玉红膏组;④黄连膏组。隔日换药一次。

耳静脉注入荧光素 Na100mg/kg,注毕后在 15'、30'、60'、90'和 120',分别用 2ml 生理盐水冲洗创面,收集冲洗液,离心 1000rpm/分×5,取上清液,在紫外分光光度计 490 $\mu$ m 测定荧光物光密度。观察创伤后第 4、7、14、21 天局部微血管通透性的动态变化,及外用中药对微血管通透性影响。

(3)全身毛细血管通透性实验:实验分为对照组和实验组(生肌膏),在硫喷妥钠 75mg/kg 静脉麻醉下行右侧股动脉插管达左心,供注入荧光素 Na 用。左侧股动脉插管供采血测定血浆荧光物浓度,作双侧输尿管插管收集尿液,取血和尿液按局部微血管通透实验方法作荧光为浓度检测<sup>[3]</sup>。

(4)创面毛细血管形态学观察:从对照组及生肌膏组创伤 7 天的创面,切取肉芽组织制作光镜及电镜标本观察。

## 结 果

1. 局部毛细血管通透性在创面愈合中的动态变化:发现注入 30 分钟时,伤口局部荧光

物浓度最高,以后逐渐下降。(见图 1)。

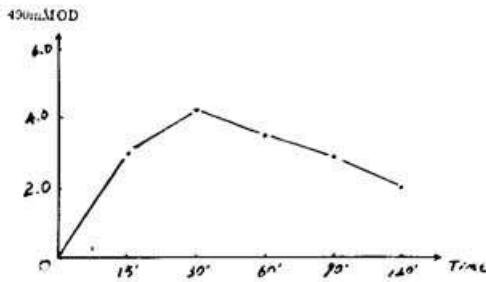


图 1 局部微血管通透性动态

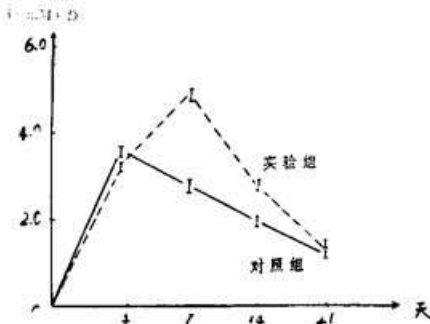


图 2 创面愈合中局部微血管通透性动态

取术后 4、7、14、21 天 120 分钟荧光物光密度作 120 分钟积分结果显示,创面荧光物浓度在创伤 4 天两组无明显差异( $P>0.05$ )。7~14 天实验组出现高峰,而对照组仍持续下降( $P<0.05$ )(见图 2)。重复结果一致。说明外用中药在伤口愈合中期可使局部毛细血管通透性显著增高。

2. 外用中药对局部毛细血管通透性的影响:外用中药生肌膏、玉红膏、黄连膏对局部毛细血管通透性影响的动态研究,发现上述外用中药具有相同的表现,均可使伤口愈合中期毛细血管通透性维持在较高水平,与对照组比较有显著差异( $P<0.05$ ),说明具有“假脓长肉”作用的外用中药对毛细血管通透性的影响基本一致(见表 1)。具有可重复性。

表 1:外用中药对局部微管通透性的动态影响  $\bar{X} \pm SD$

组别	时间	4 天	7 天	14 天	21 天
对照组		5.31±1.53	3.32±1.00	3.07±0.99	2.41±0.91
生肌膏		4.30±1.94	5.84±0.98	5.15±1.90	3.02±0.89
玉红膏		5.34±1.40	5.85±1.24	4.90±1.08	3.05±0.95
黄连膏		7.05±2.26	6.05±1.88	5.54±1.61	2.25±0.71

t 检验  $P<0.05$

3. 全身毛细血管通透性的动态观察:实验结果表明,血中荧光物的清除率高峰在 30',两组结果相近( $P>0.05$ )。两组尿中荧光物的排出亦无明显差异( $P>0.05$ ),重复实验结果一致。表明外用中药对全身毛细血管通透性无明显影响。

4. 创面毛细血管显微及超微结构:光镜下观察:两组肉芽组织均可见大量毛细血管增生,毛细血管分支多且与肉芽组织表面垂直排列,肉芽组织中有大量成纤维细胞及各类白细胞,胶原纤维排列松散。生肌膏组与对照组相比,有以下特点:(1)毛细血管数量较多;(2)毛细血管管腔扩大;(3)有可见毛细淋巴管;(4)毛细血管内皮细胞体积较大;(5)胶原纤维较纤细、松散。

电镜所见两组毛细血管大多数为正常的

新生毛细血管:即管壁主要由一层内皮细胞组成,细胞基底面附于基膜上,基膜连续、清晰,内皮细胞呈扁平梭形,细的毛细血管由一个内皮细胞环绕管的周径,较粗的毛细血管由 2~5 个内皮细胞环绕,其中以 2 个内皮细胞环绕的居多数。内皮细胞胞质内有大量吞饮小泡(图 3、4),是由细胞临腔面或基底面的细胞内凹形成的,内皮细胞外而有周细胞紧贴,内皮细胞之间有紧密连接,偶见有的毛细血管内皮细胞间分离,基膜也断开呈间断性内皮,内皮细胞离开处的细胞膜完整无损,形成血窦样结构。

生肌膏组与对照组比较,肉芽组织内毛细血管超微结构有如下特点:(1)内皮细胞胞质内吞饮小泡数量显著增多增大;(2)内皮细胞胞质变薄,有的变得极薄,有的甚至仅有胞膜;(3)内皮细胞临腔面有许多皱褶样突起(图 5)。

生肌膏组肉芽组织的基质中,常见有机能活跃的 M,胞质内有大量酶体或大量吞噬体,常伸出较长的伪足(图 6)。常见成纤维细胞处于机能活跃状态,即胞浆内有大量粗面内质网,高尔基体也发达,核仁非常明显。这些都表示其合成蛋白质的机能活跃。

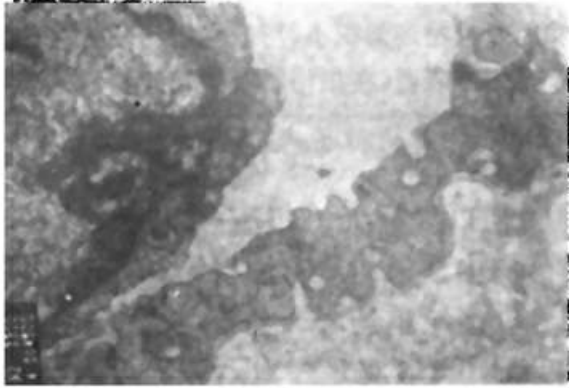


图 3 实验组内皮细胞腔面及基底面均有胞膜内凹形成吞饮小泡。14500X

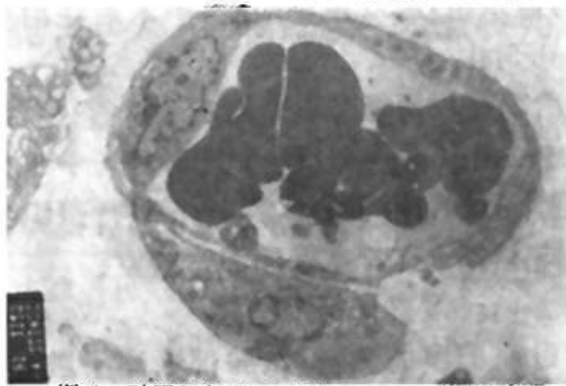


图 4 对照组新生毛血管内皮细胞腔面较光滑胞质内吞饮小泡少。



图 5 实验组新生毛血管内皮细胞变薄,内皮细胞腔面有许多皱褶样突起,胞质内吞饮小泡多。3400X

### 讨 论

全身毛细血管通透性升高是感染创伤的一个重要的病理过程<sup>[3]</sup>。因此,有效地抑制全身毛细血管通透性升高成为改善微循环障碍促进机体转机的一个重要手段。

本实验结果表明,局部应用外用中药对全身毛细血管通透性没有直接影响,可避免发生

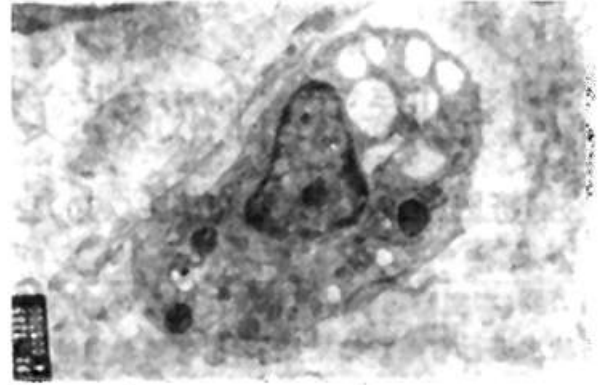


图 6 实验组机能活跃的 MQ 胞浆内有大量的各级深酶体和吞噬空泡伪足较多 5700X

微循环障碍。但外用中药对创面毛细血管通透性却有显著的促进作用,其高峰主要表现在伤口愈合中期,恰巧是临床的生肌长肉期,此期的脓液量明显增多,而且比较粘稠,显然,创面大量的脓液是与外用中药提高创面局部毛细血管通透性密切相关。电镜观察结果表明,外用中药可以提高内皮细胞的双向运输机能。内皮细胞的运输机能是由其胞浆内的吞饮小泡完成的,吞饮小泡将血液中各种分子摄取后卷入胞浆,运输到靠基底膜表面对侧,同时也将基质细胞的代谢产物通过基底膜渗透,从吞饮小泡迅速运至管腔内<sup>[4]</sup>,生肌膏组创面毛细血管内皮细胞浆内吞饮小泡明显多于对照组,而且小泡体积也较大,内皮细胞变薄,这样均有利于物质的运输,此外,内皮细胞腔面有许多皱褶突起,也与增加内皮细胞的表面面积、增强物质吸收转运有关。内皮细胞的运输作用增强,致使血液中的有形及无形成分等渗到创面,为基质内的 M、成纤维细胞等及时提供了足够的营养及各种生长因子和淋巴因子等,促进了 M 和成纤维细胞的增殖,显著增强了创面局部细胞免疫和体液免疫功能,调节了伤口愈合过程,进而加速创伤愈合。

本实验结果提出增加毛细血管通透性是外用中药的一个重要特征,是“偎脓长肉”作用机制的一个重要方面。而外用中药对毛细血管通透性影响的分子水平研究尚需深入。

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## Abstract of Original Articles

### A motive study of the capillary permeability during wound healing — First session of research program on “leaning on the pus to promote regeneration”

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Improved Saba capillary permeability experiment method was adopted in studying the mechanism of external application of Chinese herbs based on the theory of “leaning of the pus to promote regeneration” over the wound surface. The result of experiment indicated that external application of the Chinese herb could enhance local capillary permeability of the wound surface. There was significant difference ( $P < 0.05$ ) between external application of the Chinese herb group and the control group during middle stage of healing of the wound surface with local fluorescent concentration method. But there was no significant difference ( $P < 0.05$ ) between them with local plasma fluorescent clearance rate method and urinary excretion rat. It suggested that external application of the Chinese herb did not influence the capillary permeability of the body as a whole. It bears prominent regulating action of local capillary permeability.

**Key words** Capillary permeability External application of Chinese herb  
Healing of the wound surface

(Original article on page 5)

### Influence of experimental adhesion of flexor tendon treated with Injection Chuanxiongqin (CXQ)

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In this article, the influence of Injection CXQ in the treatment of adhesion of chicken deep flexor tendon model was observed and it was compared with antiadhesive action of dimethicone and normal saline. The results showed that sliding function of the CXQ and dimethicone group was better in small adhesion surface of the injured tendon. There were significant difference ( $P < 0.05, P < 0.01$ ) as compared with normal saline group. But in aspect of repairment of the tendon, the CXQ group was superior than the dimethicone group. It indicated that locally application of injection CXQ within the sheath of the tendon bears both the action of alleviation of the peri-tendoneous adhesion and doesn't influence of healing process of the tendon itself.

**Key words** Injection Chuanxiongqin Adhesion of flexor tendon  
Prophylactic and treatment

(Original article on page 8)

### **Electrophysiological study on rabbit sciatic nerve after clamp injury**

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In this article ,the results of electrophysiological study on rabbit sciatic nerve after clamp injury indicated that firstly there were prolongation of insertion potential of EMG ten days after injury of the nerve,the duration shortened gradually along with regeneration of the nerve. Secondly ,regeneration small potentials could be recorded at 20 days post—traumatically. Thirdly, induced muscular contraction potentials could be recorded 30 days after nerve injury . Fourthly, the average standard nerve regeneration velocity was 2. 93mm/day,the utmost being 4mm/day. The aim of study is to offer a clinical criteria of nerve regeneration and a reference of related researches.

**Key words**     Sciatic nerve     Electromyography  
Nerve regeneration     Rabbit

(Original article on page 11)

### **A comment on treatment of traumatic obstinate swollen of the limb based on the theory of phlegm**

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In this article ,treatment of traumatic obstinate swollen of the limb based on TCM theory of phlegm obtained good results. Thirty six caese were treated and cured copmletely. The theoretical basis and foundation of treatment based on the theory of phylegm were discussed in detail.

**Key words**     Swollen of limb     Traditional Chinese medicinal therapy

(Original article on page 13)

### **A preliminary exploration of biomechanics on fracture of tibial plateau treated with prize—poke reduction method**

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Ten cases of fracture of tibial plateau treated by prize—poke reduction method with bone fracture round mail. Two nails were applied simultaneously in 4 cases of which the degree of cave in excessed more than 10mm. The remote therapeutic results after reduction were good in 7 cases;3, fair. Analysis of the principle based on biomechanics of reduction with the prize—poke method ,fixation and physical exercise were performed, it is realized that it coincides with the principle of biomechanics.

**Key words**     Fracture of tibial plateau Prize—poke method Biomechanics

(Original article on page 31)