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Effect of nano-silver hydrogel composite antibacterial film mulching on the second degree scald rabbits model

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ABSTRACT

Objective: To verify the external use of nano-silver hydrogel composite antibacterial film on the rabbits scald model. Methods: Scalded rabbits back with constant temperature of 100 DEG C water, established the deep second degree burn rabbit model successfully . Describe scald area with transparent sulfuric acid paper, observe the time of rabbit dorsal skin crusting , local swelling and infection of scald, and integral, take the wound for pathological analysis. Results: high , medium, low doses of nano-silver gel coated groups can obviously promote the healing of burn wound , can avoid the formation of blisters and early stage of infection, improve tissue pathological change . Conclusion: Nano-silver hydrogel composite antibacterial film has good therapeutic effect on scald.

KEYWORDS

Nano-silver hydrogel; External use; Antimicrobia; II degree scald model; integral.



INTRODUCTION

Burn is common body injury, wound management is an important part of burn wound treatment, besides the operation treatment, most wound needs changing fresh dressing. External application medicine reasonable can directly influence the deep second degree scald wound healing period and the whole course of treatment and prognosis. Nano-silver has wide antimicrobial spectrum, lasting effect, not easy to produce resistance etc.. At present, all kinds of nano silver products used in clinical, such as nano silver gel, nano silver dressing, nano silver catheter. Nano-silver gel is particularly wide spread in clinic application, obvious effect in the treatment of cervicitis, vaginitis, hemorrhoids, rhinitis etc^[1]. This paper observed nano-silver hydrogel composite antibacterial effect of treatment on rabbit model of II degree scald film.

MATERIALS AND METHODOLOGY

Materials

Instruments and reagents drugs: Nano-silver hydrogel wound film, provided by Isotope Research Institute of Henan Academy of Sciences limited liability company, batch number 20120712-7; Jingwanhong ointment for scald, Tianjin Darentang Jingwanhong Pharmaceutical Company Limited production, batch number 211793; Qiaomier depilatory creams, Guangzhou Yibai Ya cosmetics Limited production, batch number 20110321; sulfuric acid paper, Zhejiang Minfeng special paper Limited by Share Ltd production, batch number 20121218. SHHW21600S type electric heating constant temperature water bath, Shanghai Yuejin Medical Instrument Co., Ltd production; FA2204B electronic balance, Shanghai Precision Scientific Instrument Co., Ltd production.

Animals :Japanese big ear rabbits, half male and half female, ordinary level, provided by the Henan Kangda laboratory animal Co. Ltd., animal Certificate No. 1005365.

METHODOLOGY

Took 36 healthy Japanese big ear rabbits, 2 ~ 2.5kg, half male and half female. The back of rabbit bilateral hair removal area of about 20cm * 15cm, made 30 rabbits model on the second day. The ear vein injection of 20% urethane (1g/kg) anesthesia, with a diameter of round cotton pad 1.8cm at temperatures of 100 DEG C boiling water infiltration after boiling, immediately placed in skin area, pressure 10s, each side had 3 circular wounds, each animal was a total of 6 wound, the wound diameter 1.8cm, an area of about 2.54cm², made the model of deep second degree burn. Clean the wound with 1/5000 furacilin and sterile gauze. Then immediately IP sterilized saline 20 mL/ rabbit; depicting the rabbit skin scald area of graphics with transparent sulfuric acid paper, weight the said drawings in electronic balance, the weight indicated the scalded skin area^[2-4]. Mold according to the area of scald rabbits were randomly divided into 5 groups, high, medium, low dose of nano silver gel were given to the corresponding group. Jingwanhong group coated Jingwanhong ointment for scald (thickness 2mm), the blank group and the model group covering the physiological saline. Each group with cling film covered adhesive tape fixed after dosing, every day to keep drugs in contact with the skin for 6 hours, use drug 18 days continuously.

The index and methods of experiment^[5-6]. In the 1st, 6th, 12th, 18th days covering the ulcer surface along the wound edge tracing with sulfuric acid paper, weighing scalded skin area of paper weight, the weight change expresses the change of skin scald area, thus evaluation of the effect of the tested drugs. The next day after the last injection, sampling examination of skin histopathology, clipping the burn site, fixed in 10% Formaldehyde Solution, embedded in paraffin, HE staining, observed under light microscope and compared each healing degree scalded rabbits skin.

RESULT AND DISCUSS

Effect of nano-silver hydrogel composite antibacterial film on scalded rabbits model.

TABLE 1 Effect of nano-silver hydrogel composite antibacterial film on scalded rabbits model ($\bar{x} \pm s$)

Groups	n	At different time after paper weight difference (mg)		
		The 6 th day	The 12 th day	The 18 th day
Blank	6	0±0**	0±0**	0±0**
Model	6	31.90±27.13	82.05±29.71	137.52±26.03
Jingwanhong	6	69.68±33.56*	124.55±35.16*	164.62±35.38
High dose	6	63.55±25.67*	108.92±30.45	147.97±13.90
Medium dose	6	69.08±37.21	118.33±18.16*	166.50±20.46*
Low dose	6	68.52±11.06*	107.17±7.18	158.73±18.69

Note: compared with the model group, * $P<0.05$, ** $P<0.01$

Table 1 shows, compared with the blank group, the model group's area of the skin paper weight difference was significant ($P<0.01$), that made the scalded rabbits model of success. Compared with model group, in the sixth days, high, low dose of nano silver gel coated group and Jingwanhong group rabbits scald skin area paper weight difference significantly increased ($P<0.05$); in twelfth days, medium dose of nano silver gel group and Jingwanhong group rabbits scald skin area paper weight increased significantly ($P<0.05$); in the medication for eighteenth days, the medium dose of nano silver gel group rabbits scald skin area paper weight difference was significantly increased ($P<0.05$).

Effect of nano-silver hydrogel composite antibacterial film on the local skin irritation infection integral.

TABLE 2 Effect of nano-silver hydrogel composite antibacterial film on the local skin irritation infection integral ($\bar{x} \pm s$).

Groups	n	the local skin irritation infection integral						
		The 1 st day	The 2 nd day	The 3 rd day	The 6 th day	The 12 th day	The 18 th day	
Blank	6	0±0	0±0	0±0	0±0	0±0	0±0	
Model	6	1±0	1.33±0.52	1.50±0.55	1.00±0.63	0.17±0.41	0.17±0.41	
Jingwanhong	6	1±0	1±0	1±0*	0.50±0.55	0±0	0±0	
High dose	6	1±0	1±0	1±0*	0±0**	0±0	0±0	
Medium dose	6	1±0	1±0	1±0*	0.17±0.41	0±0	0±0	
Low dose	6	1±0	1±0	1±0*	0.50±0.55	0±0	0±0	

Note: compared with the model group, * $P<0.05$, ** $P<0.01$

Table 2 shows, in the third days, high, midium, low dose of nano silver gel coated group and Jingwanhong group rabbits skin irritation infection integral value decreased obviously ($P<0.05$); in the medication for sixth days, high dose of nano silver gel coated group rabbits skin irritation infection integral value decreased significantly ($P<0.01$), medium dose nano silver gel coated group rabbits skin irritation infection integral value decreased obviously ($P<0.05$); in the treatment of 12th, 18th days, all rabbits skin irritation infection disappeared nearly.

Effect of nano-silver hydrogel composite antibacterial film on the skin scab time.

TABLE 3 Effect of nano-silver hydrogel composite antibacterial film on the skin scab time ($\bar{x} \pm s$).

Groups	n	The scab time(d)	Scab off time(d)
Blank	6	0±0**	0±0**
Model	6	5.00±0.63	8.83±0.75
Jingwanhong	6	2.67±0.81**	6.67±0.82**
High dose	6	2.83±0.75**	6.67±0.52**
Medium dose	6	3.00±0.63**	7.00±0.63**
Low dose	6	3.33±0.52**	7.33±1.03**

Note: compared with the model group, * $P<0.05$, ** $P<0.01$

Table 3 shows that, compared with the model group, high, midium, small doses nano silver gel coated group and Jingwanhong group can significantly shorten the time of scalded rabbits skin scab ($P<0.01$) and the time of scab off ($P<0.01$).

Effect of nano-silver hydrogel composite antibacterial film on local skin tissue morphology

TABLE 4 Effect of nano-silver hydrogel composite antibacterial film on local skin tissue morphology

Groups	n	-	+	++	+++	P
Blank	6	6	0	0	0	<0.01
Model	6	0	0	0	6	
Jingwanhong	6	0	0	6	0	

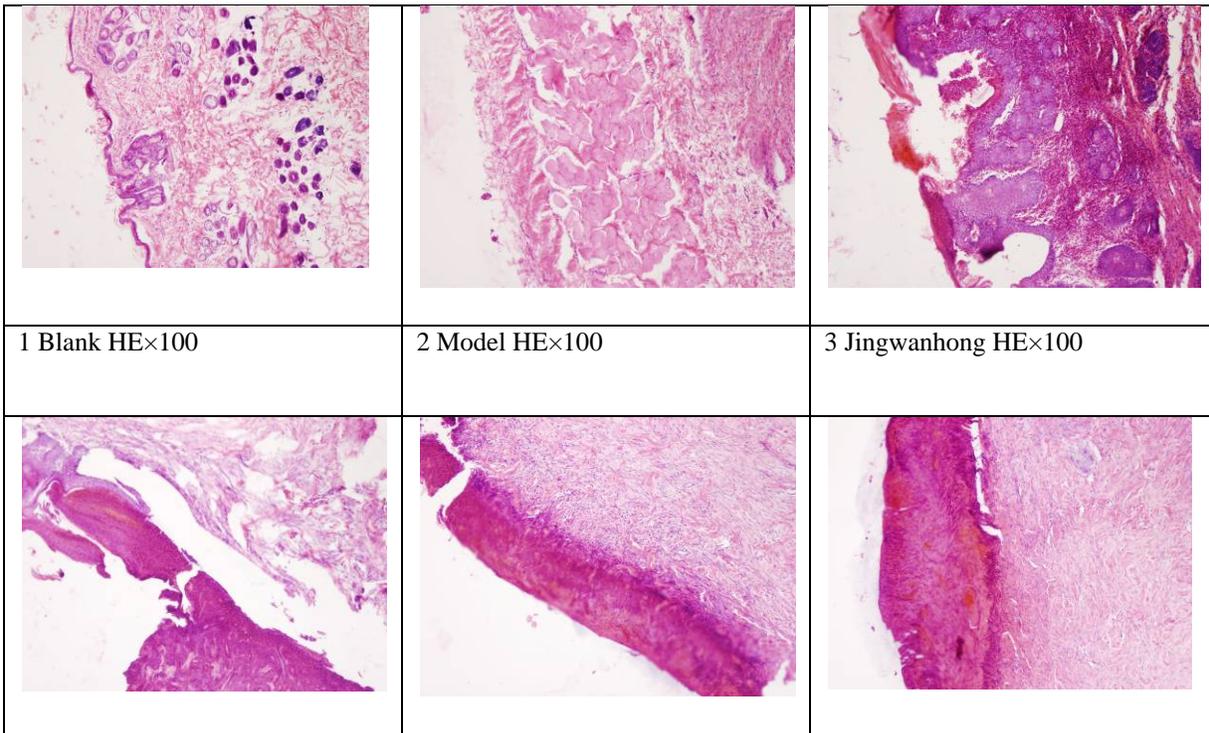
High dose	6	0	4	2	0	<0.01
Medium dose	6	0	2	4	0	<0.01
Low dose	6	0	0	2	4	

"-": the keratinized layer, squamous cells, hair follicles, sebaceous glands, hair glands and subcutaneous tissue were normal; "+": the cornified layer becomes thinner, squamous slightly hyperplasia, follicle less partial denaturation, hair follicle gland, sebaceous gland cells slightly subcutaneous tissue hyperplasia, basically normal; "+ +": inflammatory cell exudate keratinized layer thickening and a small amount of phosphorus, columnar epithelial hyperplasia, follicle partial denaturation, hair follicle gland, sebaceous glands, phosphating, subcutaneous tissue was replaced by granulation tissue; "+ + +": keratinized layer thickening and inflammatory cell exudation, squamous hyperplasia, degeneration of hair follicles, sebaceous glands, hair glands disappeared, subcutaneous tissue is replaced by the amount of granulation tissue .

Table 4 shows, the Ridit test, compared with the blank group , the model group’s skin appears significant pathological changes ($P<0.01$), that made the scalded rabbits model of success. Compared with the model group, high, midium dose of nano silver gel coated group and Jingwanhong group could significantly improve scalded rabbits model of skin pathological changes ($P<0.01$).

All rabbits back scalding local tissue morphological observation results see Appendix:The blank group, epithelium keratinized layer, squamous cells of intact and relatively thin, subcutaneous tissue in the hair follicle and hair follicles and sebaceous glands were normal, subcutaneous tissue were normal, photo 1;Model group, epithelium keratinized layer, squamous cells completely denatured, subcutaneous tissue in the hair follicle and hair follicle gland and sebaceous glands were denaturation vanishes, subcutaneous tissue by the amount of granulation tissue is replaced, photo 2;Jingwanhong group, keratinized layer thickening of the epithelium, squamous cells obvious hyperplasia and inflammatory cell exudation, subcutaneous tissue in the hair follicle, hair follicle and sebaceous glands were phosphating; keratocyst layer part of animal tissue epithelial squamous epithelium has disappeared, subcutaneous tissue hyperplasia, cystic degeneration of hair follicle and sebaceous gland completely, gland disappears, subcutaneous tissue by the amount of granulation tissue is replaced, photo 3;High dose group, keratinized layer of epithelial tissue by the large amount of inflammatory cell exudate is replaced, squamous cells have hyperplasia, subcutaneous tissue in the hair follicle, hair follicle gland and sebaceous gland epithelial cells disappeared, replaced by a large number of granulation tissue, photo 4;The medium dose, keratinized layer, squamous epithelial tissue disappeared by the amount of inflammatory cells and degeneration of tissue is replaced, the subcutaneous tissue in the hair follicle, hair follicle and sebaceous gland disappeared, subcutaneous tissue by the amount of granulation tissue is replaced, photo 5;The low dose group, keratinized layer, squamous cells of the epithelial tissue disappeared by the amount of exudation and inflammatory cell degeneration is replaced, the subcutaneous tissue in the hair follicle, hair follicle and sebaceous gland disappears, subcutaneous tissue by the amount of granulation tissue is replaced, photo 6.

Appendix



4 High dose HE×100	5 Medium dose HE×100	6 Low dose HE×100
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CONCLUSIONS

External medicine can not only provide a best environment for burn wound healing, prevent wound infection, but also has the advantages of convenient use, safety, quick drug absorption, minor adverse reaction. For burn wound dressing variety, but how to reasonable, effective use to control wound infection, so far in the burn treatment is still the focus of discussion. Nano silver is the use of silver particles combination with the bacteria protein sulfhydryl (-SH), cause the degeneration, the sulfhydryl enzyme inactivation exerts its antibacterial function, this advantage greatly promote the wound healing^[7]. Silver nanoparticles as non antibiotic bactericide natural new generation, with stability physicochemical properties and the ability of broad-spectrum sterilization^[8]. Strong penetration ability of silver nanoparticles, quickly penetrate into skin by pores, kill various bacteria, fungi, mycoplasma, chlamydia and other bacteria in a few minutes, and the bacterial resistance to elemental silver is extremely rare, so it is applied widely in the field of medical biology.

For better judgment the effect of nano silver gel coated for external use, this experiment evaluate the area of skin burns, scald pathological changes. Burn area reflect the nano silver gel treatment of scald case directly. Histopathological changes reflect the degree of the damaged tissue layers of skin inflammatory cell infiltration and healing, can directly reflect the effect of drugs. Results showed that, high, medium, low doses nano silver gel coated group can reduce the area of scalded rabbits, avoid early scald edema and infection, significantly shorten the time of local skin scald scab, and can significantly improve the skin pathological changes of rabbit scald site, suggesting that the nano-silver on scalded by certain treatment function. This experiment adopts nano silver gel coated curing scald burn, provided a simple controllable and effective method for clinical treatment.

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