3.5 times higher for creatinine (CP_{cr}) and 6.5 times higher for potassium (CP_K) than during perfusion with PSS. Glucose reabsorption from the urine also was increased during perfusion with PFE. Just as in the perfusate, low LDH activity was observed in the urine during perfusion with PFE but high activity during perfusion with PSS.

Normothermic perfusion of the kidneys for 4 h with a 20% emulsion of PFTBA based on PSS thus enables the functional integrity of the kidneys to be maintained.

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USE OF SILATRANES COMBINED WITH VISHNEVSKII'S OINTMENT IN WOUND TREATMENT

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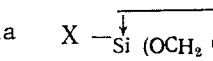
Some silatranes (organosilicon compounds with the general formula ) have been shown to possess the property of stimulating connective tissue repair [1, 2, 4, 5, 8]. However, for the practical use of silatranes a number of problems require solution, including that of the optimal therapeutic presentation [6]. The fact that all ointment (liniment) bases used for local application of therapeutic substances are not biologically inert [11] is an additional difficulty.

Vishnevskii's balsam liniment (ointment), containing tar, bismuth tribromphenate, and castor oil, has for a long time been found effective in surgical practice in the treatment of wounds. In the investigation described below Vishnevskii's ointment was tested as a carrier (liniment base) of silatranes.

EXPERIMENTAL METHOD

Two silatranes — 1-(ethoxy)silatrane and 1-(chloromethyl)silatrane — synthesized at the Irkutsk Institute of Organic Chemistry, Siberian Branch, Academy of Sciences of the USSR, were studied. Using Vishnevskii's ointment (VO) as the base, liniments of silatranes were made up in concentrations of 0.5 and 5%. For comparison, liniments in the same concentrations based on a mixture of lanolin and castor oil (LC) in the ratio of 1:3 were used. Two experimental models were created in experiments on laboratory rats: 1) a circular wound defect in the occipital region obtained by excision of a piece of skin 230 mm^2 in area, down to fascia. The liniments were applied daily and observations continued until the wound was fully healed. Regenerating skin was investigated by the usual histological methods; 2) a circular skin defect in the dorsal region with an implanted transparent plastic ring to prevent contraction and epithelization [7]. The liniments were applied daily and on the 7th day granulation tissue (GT) developing in the defect was removed, weighed, and examined histologically and biochemically [7]. The results were subjected to statistical analysis by the nonparametric [3] U test.

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TABLE 1. Mean Times of Wound Healing in Rats Treated with Liniment Bases and Silatranes

Group of animals	Time of healing, days	Acceleration, percent of control	Acceleration, percent relative to VO
1. Control	22,0±0,1	—	—
2. LC	20,0±0,2	9,1	—
P_{1-2}	0,05		
3. VO	17,2±0,2	21,8	—
P_{1-3}	0,005		
P_{2-3}	0,01		
4. 1-(ethoxy)silatrane 0,5% LC	16,0±0,3	27,3	—
P_{2-4}	0,005		
5. 1-(ethoxy)silatrane 5,0% LC	17,5±0,4	20,5	—
P_{2-5}	0,01		
6. 1-(ethoxy)silatrane 0,5% VO	14,0±0,1	36,4	18,6
P_{3-6}	0,01		
P_{4-6}	0,05		
7. 1-(ethoxy)silatrane 5,0% VO	15,3±0,2	30,5	11,1
P_{3-7}	0,05		
P_{5-5}	0,05		
8. 1-(chloromethyl)silatrane 0.5% in LC	14,0±0,2	36,4	18,6
P_{2-8}	0,001		
P_{6-8}	0,05		
9. 1-(chloromethyl)silatrane 5.0% in LC	15,6±0,2	29,1	9,3
P_{2-9}	0,005		
P_{7-9}	0,05		
10. 1-(chloromethyl)silatrane 0.5% in VO	12,6±0,3	42,7	26,8
P_{3-10}	0,001		
P_{7-10}	0,05		
11. 1-(chloromethyl)silatrane 5.0% in VO	14,2±0,4	35,5	16,0
P_{3-11}	0,005		
P_{9-11}	0,05		

Legend. Each group consisted of ten rats.

TABLE 2. Biochemical Parameters of FT after Treatment with Liniment Bases

Parameter studied	Control	LC	VO
Weight of tissue, g	1,17±0,01	1,85±0,03	1,15±0,13
DNA, g/100 g dried, defatted tissue	2,91±0,66	2,11±0,19	3,19±0,30
RNA, g/100 g dried, defatted tissue	2,37±0,25	2,38±0,21	2,30±0,30
Hydroxyproline, g/100 g dried, defatted tissue	2,04±0,04	2,49±0,20	3,09±0,31
Tyrosine, g/100 g dried, defatted tissue	2,17±0,05	2,53±0,26	2,90±0,45
Hexosamines, g/100 g dried, defatted tissue	0,57±0,08	0,90±0,03	1,30±0,46
Hexuronic acids, g/100 g dried, defatted tissue	0,64±0,07	0,41±0,04	0,97±0,15
Hexoses, g/100 g dried, defatted tissue	2,13±0,17	3,31±0,23	4,01±0,45
Sialic acids, g/100 g dried, defatted tissue	0,71±0,12	0,81±0,05	0,58±0,05

Legend. Here and in Table 3, each group consisted of six rats.

EXPERIMENTAL RESULTS

Application of LC and VO to the wound surface was followed by more abundant development of granulation than in the control (without ointment) and epithelization took place more rapidly, especially under the influence of VO (Table 1). Addition of silatranes to the liniments caused much more marked acceleration of healing, and this was particularly true of silatranes based on VO. Of the two, 1-(chloromethyl)silatrane was more effective than the other. Both silatranes in both liniment bases gave better results in a concentration of 0.5%.

The histological investigation showed that under the influence of silatranes the regenerating skin consisted of well vascularized tissue rich in lymphocytes and mature collagen fibers. In the control animals and after application of liniment bases, blood vessels and collagen fibers were less well developed in the regenerating skin. The use of silatranes caused more marked thickening of the newly formed epithelium, deep growth of the epithelium was observed, and rudiments of hair bulbs appeared.

The effect of VO on GT from the biochemical aspect has not previously been studied. It was found (Table 2) that VO inhibits inflammatory changes (reduces the sialic acid concentration [10]) and stimulates accumulation of connective-tissue biopolymers, such as collagen (hydroxyproline), total glycoproteins (hexosamines), glycosaminoglycans (hexuronic acid), and glycoproteins (hexoses), in GT. In particular it should be noted that VO stimulated glycoprotein components, for they optimized the conditions for collagen fibrillogenesis [9]. This effect was much stronger with VO than with LC.

Addition of silatranes to VO strengthened the favorable effect of VO on the biochemical parameters of GT (Table 3). In particular, the collagen (hydroxyproline) content in GT rose sharply.

TABLE 3. Biochemical Parameters of GT after Treatment with 1-(Chloromethyl)silatrane (I) and 1-(Ethoxy)silatrane (II)

Parameter studied	VO	VO+I (0,5 %)	VO +I (5 %)	VO+II (0,5 %)	VO +II (5 %)
Weight of tissue, g	1,15±0,13	1,46±0,13	1,46±0,09	1,60±0,03	1,57±0,07
DNA, g/100 g dried, defatted tissue	3,19±0,30	3,34±0,49	3,09±0,43	3,16±0,69	2,89±0,34
RNA, g/100 g dried, defatted tissue	2,30±0,20	2,37±0,15	2,39±0,40	1,92±0,26	1,72±0,16
Hydroxyproline, g/100 g dried, defatted tissue	3,09±0,31	3,85±0,22	3,61±0,29	3,81±0,42	3,79±0,34
Tyrosine, g/100 g dried, defatted tissue	2,90±0,25	2,85±0,27	2,78±0,32	3,22±0,53	2,89±0,61
Hexosamines, g/100 g dried, defatted tissue	1,30±0,07	1,32±0,30	1,32±0,40	1,47±0,48	1,10±0,38
Hexuronic acids, g/100 g dried, defatted tissue	0,97±0,10	0,87±0,16	1,35±0,29	0,88±0,12	0,88±0,17
Hexoses, g/100 g dried, defatted tissue	4,01±0,40	2,97±0,53	3,57±0,51	3,83±0,39	3,82±0,45
Sialic acids, g/100 g dried, defatted tissue	0,58±0,05	0,57±0,07	0,61±0,16	0,54±0,03	0,60±0,06

These biochemical data were confirmed by microscopic examination. Under the influence of silatranes in conjunction with VO, GT contained the largest number of collagen fibers staining positively with Van Gieson's method; a strong histochemical reaction for glycosaminoglycans also was observed.

The results are evidence that a combination of silatranes with Vishnevskii's balsam liniment is a worthwhile therapeutic form for local application of silatranes in wound treatment. When silatranes are added to Vishnevskii's ointment they exhibit their wound-healing effect to the fullest degree.

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