EFFECT OF TETRACYCLINES ON PERMEABILITY OF ERYTHROCYTES IN BURNS

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Glycocycline, in a concentration of 40 units/ml, reduces the permeability of erythrocytes to fluorescein. This effect is exhibited on erythrocytes both of healthy persons and of patients with burns. Morphocycline, in the same concentration, reduces the permeability of erythrocytes only in the period of exhaustion following burns.

* * *

Specific incorporation of tetracyclines in the lipoprotein membrane of bacteria [1, 2], the mitochondria of various organs and tissues [6], and the blood cells (erythrocytes [4, 5]) points to their role in certain changes in the function of plasma membranes, notably their permeability.

Among the most important pathogenetic disturbances in burns are changes in vascular tissue, and cellular permeability [3].

The object of the present investigation was to determine the effect of tetracyclines on the permeability of cell membranes in burns. For this purpose the action of glycocycline and morphocycline was studied on the permeability of erythrocytes in burn exhaustion.

EXPERIMENTAL METHOD

Blood was taken from 12 patients with burn exhaustion and 20 healthy persons. The patients were under observation for 2.5 months.

To a suspension of erythrocytes in physiological saline, 20 μg/ml fluoroscein and glycocycline or morphocycline in a dose of 40 units/ml* were added. Erythrocytes incubated with fluorescein without addition of the tetracyclines acted as control. After incubation for 1 h at 37°, the washed erythrocytes were hemolyzed. The fluorescein which had penetrated into the erythrocytes and that contained in the transparent supernatant were determined fluorometrically [3]. The results were expressed in microamperes relative to one hematocrit volume. Synthetic glycocycline produced by the Moscow Research Institute of Antibiotics, and morphocycline produced by the Leningrad Research Institute of Antibiotics were used in the experiments.

EXPERIMENTAL RESULTS

The data given in Table 1 and Fig. 1 show that incubation of erythrocytes of healthy persons in a medium containing glycocycline in a concentration of 40 units/ml considerably reduced their permeability to fluorescein. An increase in the glycocycline concentration to 200 units/ml almost completely stopped the penetration of fluorescein into the erythrocytes (the "inhibition effect").

During incubation of the erythrocytes in medium containing morphocycline in a concentration of 40 units/ml, their permeability was almost identical with that in the control, but when the concentration of morphocycline in medium was 200 units/ml, an "inhibition effect" developed.

*Glycocycline or morphocycline, in a dose of 200 units/ml, was added only during incubation of erythrocytes from healthy persons.

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TABLE 1. Effect of Glycocycline and Morphocycline on Permeability of Erythrocytes to Fluorescein

Incubation medium of erythrocytes	Permeability of erythrocytes to fluorescein (in μA)					
	healthy		patients			
			period of burn exhaustion		period of clinical recovery	
	n	M±m	n	M±m	n	M±m
Control	40	9.3±0.472	12	35.5±1.25	12	16.35±0.75
Glycocycline concentration 40 units/ml	40	4.6±1.28	12	2.0±0.234	11	6.85±0.176
Morphocycline concentration 40 units/ml	40	9.6±0.473	10	1.87±0.521	12	14.7±0.82

Note: n represents number of investigations.

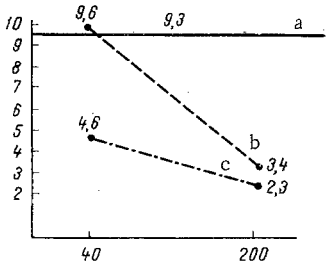

Fig. 1. Effect of glycocycline and morphocycline in concentrations of 40 and 200 units/ml on permeability of erythrocytes of healthy persons to fluorescein. a) Control; b) morphocycline; c) glycocycline. Abscissa: concentration of tetracycline in medium (units/ml); ordinate: permeability of erythrocytes (in μA).

In patients with burns the effect of glycocycline was also to lower the permeability of the erythrocytes. The "inhibition effect" reached a maximum in the patients during the period of burn exhaustion. Whereas the permeability of erythrocytes from healthy persons was lowered on the average by half under the influence of medium containing glycocycline in a concentration of 40 units/ml, the permeability of erythrocytes taken from patients in the period of burn exhaustion was reduced under the same conditions by 17.7 times. In the period of clinical recovery the permeability of the erythrocytes was lowered by 2.4 times under the influence of glycocycline.

Incubation of erythrocytes in a medium containing morphocycline in a concentration of 40 units/ml caused a considerable (by 16.8 times) decrease in permeability of the erythrocytes during burn exhaustion, whereas in the same concentration it had practically no effect on erythrocytes of healthy persons or of patients in the period of clinical recovery. Glycocycline thus caused a marked decrease in the permeability to fluorescein of erythrocytes taken from patients with burns in the period of burn exhaustion and the period of clinical recovery, and even of erythrocytes taken from healthy persons. Morphocycline, however, gave an "inhibition effect" in the erythrocytes only from patients in burn exhaustion.

The increase in permeability of erythrocytes from patients with burn exhaustion was evidently due primarily to conformational changes in protein structure, especially in the erythrocyte membrane, caused by the pathological process. These changes could facilitate the formation of bonds between morphocycline and the erythrocyte membrane proteins which were stronger than the labile bonds formed between fluorescein and the proteins [3]. In patients with burn exhaustion, inhibition of accumulation of fluorescein in the erythrocytes during incubation in medium containing morphocycline in a concentration of 40 units/ml probably depended on these structural disturbances caused by the pathological process. It can also be postulated that glycocycline itself modified the conformational polymer structure of the membrane, lowering its permeability.

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