the course of the toxemia and intensifies tissue breakdown. However, corrective therapy must take into account not only the bacterial, but also the tissue character of the toxemia in thermal burns.

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PROPERDIN AND PROTEIN COMPOSITION OF THE LYMPH AND BLOOD IN BURNS

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Experiments on 25 dogs showed that burns are accompanied by a regular redistribution of plasma proteins between the body fluids and by increased lymphatic resorption. Retention of properdin, albumins, and α globulins in the tissues during burns was demonstrated indirectly. The degree of burning was found to depend on the initial properdin level.

KEY WORDS: burns; properdin; proteins; lymph.

The concentration of properdin and proteins in the lymph and blood of dogs with thermal burns was investigated.

EXPERIMENTAL METHOD

Experiments were carried out on 25 dogs of both sexes weighing 8-25 kg. A burn of the hind foot was produced in 20 dogs by immersing it in hot water (80°C) for 30 sec. Lymph from the afferent and efferent vessels of the popliteal lymph node and blood were obtained before burning and 3 and 24 h thereafter. Lymph and blood were obtained from five control dogs under the same conditions, but without burning. The properdin concentration was determined by a method based on its binding with inulin and subsequent mineralization of the properdin–inulin complex followed by isometric distillation of ammonia in Conway dishes, total protein by the IRF-22 refractometer, and the protein composition by electrophoresis in agar gel. The results were subjected to statistical analysis by the Fisher–Student method.

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TABLE 1. Properdin and Protein Composition of Lymph of Dogs with Burns (M ± m)

Index tested	First-degree burns			Second-degree burns		
	before burning	after burning		before burning	after burning	
		3 h	24 h		3 h	24 h
Properdin, μg/ml	2,19±1,64	6,64±2,28	10,2±2,6	7,77±2,24	4,19±1,93	3,8±0,89
P		<0,05	<0,05		<0,05	<0,05
Total protein, g%	1,75±0,18	3,74±0,54	3,35±0,76	1,75±0,18	4,37±0,39	3,04±0,66
P		<0,001	<0,001		<0,001	<0,001
Albumins, g%	0,75±0,14	2,26±0,21	1,25±0,18	0,75±0,14	1,79±0,64	1,43±0,29
P		<0,01	<0,01		<0,01	<0,001
Globulins, g%						
α_1	0,19±0,05	0,47±0,22	0,38±0,11	0,19±0,05	0,46±0,05	0,44±0,12
P		<0,05	<0,05		<0,001	<0,01
α_2	0,23±0,07	0,41±0,29	0,50±0,1	0,23±0,07	0,50±0,18	0,59±0,13
P		<0,05	<0,05		<0,01	<0,01
β	0,41±0,11	0,79±0,45	0,75±0,31	0,41±0,11	0,84±0,2	0,88±0,31
P		<0,01	<0,05		<0,001	<0,05
γ	0,27±0,12	0,23±0,04	0,40±0,16	0,27±0,12	0,53±0,24	0,46±0,25
P		>0,05	<0,05		<0,01	<0,01

Legend. P) Significance of difference compared with initial level.

EXPERIMENTAL RESULTS

The reaction of the dogs to thermal trauma differed: Nine dogs developed first-degree burns and 11 second-degree burns.

In the dogs with the first-degree burns the concentrations of properdin and total protein in the afferent lymph rose progressively 3 and 24 h after burning (Table 1). No significant changes in the blood properdin concentration were found. The total protein of the blood, however, fell by 0.18 g% after 3 h ($P < 0.001$) and by 1.2 g% after 24 h ($P < 0.05$). The increase in the protein concentration in the lymph after 3 h took place on account of a uniform increase in all its fractions except coarse-dispersed γ globulins, the level of which was unchanged. The protein concentration in the lymph after 24 h was increased mainly on account of coarse-dispersed fractions, whereas the albumin concentration in both lymph and blood was reduced. This decrease was probably connected with retention of albumins at the site of injury, as was observed after fractures [2].

In dogs with second-degree burns the properdin level in the afferent lymph and blood was significantly lowered after 3 h and, in particular, after 24 h. The total protein concentration was reduced in the blood ($P < 0.001$) but increased in the lymph. The fact that the properdin level was lowered in the blood but was not correspondingly increased but was actually lowered in the lymph, despite the increase in the total protein, is direct evidence of the binding of properdin in the tissues of the injured limb.

Changes in the protein composition of the lymph and blood in second-degree burns were identical with those in first-degree burns. However, the more severe burn caused more marked and earlier changes in the protein fractions. For instance, the blood albumin concentration was reduced ($P < 0.05$) and the γ-globulin concentration in the lymph of the dogs with second-degree burns was increased as early as 3 h, compared with 24 h in dogs with first-degree burns.

No changes in the protein composition or properdin level in the lymph and blood were found in the control dogs.

To study the character of the response of parts of the lymphatic system remote from the traumatic focus, afferent lymph was obtained from both the burned and the "sound" limbs of three dogs with first-degree burns. The total protein and properdin concentrations were found to be increased in lymph from the intact limb and also in lymph draining from the region of the burn, although admittedly, by a lesser degree. This indicates that the whole lymphatic system is involved in the response to burns.

In two cases efferent lymph from the popliteal lymph node of the burned limb could be obtained 1 week after infliction of a second-degree burn. The total protein concentration in this lymph was greater than in the afferent lymph, but its properdin concentration was lower. These changes could be the result of binding of properdin in the lymph node which still preserved its concentrating function.

Retention of properdin in the tissues and lymph nodes revealed by these experiments was evidently due to the binding of properdin with breakdown products of glycoproteins and mucopolysaccharides, the content of which in the tissues is increased after injuries [1, 4, 5]. The increase in the total protein concentration in the lymph can be explained by intensification of lymphatic resorption under the influence of glucocorticoids liberated in response to stress [3].

In the writers' view the fact that in all the dogs the α_2-globulin fraction of the blood was increased after 3 h by 0.27 g % ($P < 0.05$) is interesting. This decrease cannot be explained by increased permeability of the capillaries, for there was no decrease in the concentration of finely dispersed blood albumins under these same conditions. Most likely the reactive proteins of this fraction (α_2-neuraminoglycoprotein, α_{2HS}-glycoprotein, etc.) are bound in the interstitial tissues and are not returned in full to the blood stream by the lymphatic system. In the light of this explanation the retention of properdin, which has affinity for polysaccharide structures, in the tissues is even more interesting.

The degree of the burn was found to depend on the initial properdin level: If its blood level was low (13.1 ± 3.2 μg/ml) a first-degree burn developed, if it was high (24.7 ± 4.5 μg/ml) a second-degree burn developed, evidence of the influence of properdin on the reactivity of the tissues to burn trauma.

Burn stress is thus accompanied by a regular redistribution of plasma proteins between the body fluids. Retention of properdin, albumins, and α_2 globulins of the blood by the burned tissues was demonstrated and probably has a significant role in subsequent healing.

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