

STUDY OF THE THERAPEUTIC ACTION OF CONVALESCENT BURN SERA ON BURNED ANIMALS OF ANOTHER SPECIES

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Burn sickness is accompanied by an immunological reorganization of the organism [2-8]. The initial stage of this reorganization is the formation of a burn autoantigen (toxicity carrier), while the final stage is the development of humoral factors to protect against it—antitoxic fractions (antiburn antibodies) [2-3]. Data on the immunology of burns served as the theoretical basis for broad investigations of passive immunization of freshly burned patients with serum from a burn convalescent and for the development of methods for producing antiburn antitoxic sera by active immunization of animals with burn antigen [4, 5, 7].

It has been established that isogenous antiburn sera are of exceptionally great effectiveness in treating experimental thermal burns. Subsequent clinical investigations confirmed these data [1].

It was recently shown [4] that the therapeutic action of convalescent burn serum is not limited by the species of animal involved. Administration of serum from a dog which had recovered from a thermal trauma to burned animals of other species (mice, rabbits, guinea pigs) produced a therapeutic effect manifested in a decrease in burn intoxication and prolongation of survival time or saving of the subjects. These experiments open up broad prospects for the production of heterogeneous antiburn sera for treating burned humans.

This report is an expanded account of the data obtained by one of us (S. V. Skurkovich) in studying the therapeutic action of serum from dogs convalescing from burns on burned animals of another species, as well as of joint investigations of the therapeutic activity of serum from horses convalescing from burns with respect to burned animals of another species.

EXPERIMENTAL METHOD AND RESULTS

In order to study the therapeutic activity of serum from dogs convalescing from burns the animals were burned over 9-15% of their body surface during a 1-min exposure. Blood was taken from these dogs for serum production 15 days to 8 months after epithelization of the burn surface. In the control investigations we employed serum obtained from these dogs before they were burned or from normal dogs. The experiments were conducted on mice and rabbits.

For our experiments we selected mice weighing 18-21 g. The burns were inflicted with hot water. The lower half of the animal's body was immersed to the costal arch for 30 sec in water heated to 54 deg. In untreated mice such thermal trauma leads to 50% mortality within 24-48 h.

The dog convalescent serum was injected subcutaneously in a quantity of 1 ml 10-15 min after burning and then daily. Observations were carried out over 5 days. The control mice were injected with normal dogs serum in the same doses and at the same times.

As may be seen from the data presented in Table 1, serum from a dog convalescing from burns has a more marked therapeutic action on burned mice than normal serum.

TABLE 1. Therapeutic Action of Serum from a Dog Convalescing from Burns on Burned Mice and Rabbits

Species of animal	Treatment method	Number of animals				
		Total	Survived after burning			
			after 24 h	after 48 h	after 72 h	after 96 h
Mice	Administration of serum from dog convalescing from burns	1,313	1,000 (76%)	742 (56%)	348 (26%)	188 (14%)
	Administration of normal dog serum	1,303	802 (61%)	338 (30%)	74 (6%)	10 (0.8%)
Rabbits	Administration of serum from dog convalescing from burns	48	41 (85%)	35 (73%)	24 (50%)	17 (35%)
	Administration of normal dog serum	48	36 (75%)	14 (29%)	2 (4%)	—

In the other series of experiments we used rabbits weighing 2.5-3 kg, which were burned with boiling water (96-98°) and with the flame produced by cotton balls impregnated with alcohol. Their coats were carefully removed. The area of the burn produced by exposure to boiling water was 22-25% (1 liter of hot water was poured onto the skin for 10 sec). When the thermal injury was flame-inflicted the burn area was 35% and the exposure time 25 sec. The burned animals were injected intravenously with dog burn-convalescent serum in a dose of 10 ml twice daily for 5 days. As a control, another group of burned rabbits was injected with normal dog serum at the same times and in the same doses.

The experiments showed that dog burn-convalescent serum has a more marked therapeutic effect on burned rabbits than normal dog serum (see Table 1).

Our study of the therapeutic activity of serum from horses convalescing from burns was conducted with the Permsk Scientific Research Institute for Vaccines and Sera and the I. I. Mechnikov Moscow Institute as our bases. We used serum from four horses which had received immunizing burns and recovered from them.

The thermal exposure consisted in inflicting successive burns with red-hot iron. A total of four 3rd-degree burns were inflicted on each horse, with intervals of 8-10 days between them. The burned area constituted approximately 5-6% of the body surface for each immunizing burn.

During this work we followed the general condition of the horses, their hematological indices, and the electrophoretic characteristics of their sera.

TABLE 2. Electrophoretic Analysis of Serum from the Horse Fonarik

Date of blood taking (1957)	Albu- min	Globulins						
		α_1	α_2	α_3	β_1	β_2	T	γ
12/I (before burn)	29,1	3,5	3,4	17,0	16,5	11,0	—	13,5
16/I (after burn)	28,8	4,1	4,1	13,6	16,4	8,8	7,5	17,7
19/I » »	36,7	3,4	3,4	16,7	16,0	13,4	—	20,0
23/I » »	24,2	4,8	4,9	14,8	13,6	11,2	8,6	17,9
30/I » »	28,0	3,0	3,0	22,0	10,7	9,9	11,2	12,2
1/III » »	22,0	4,7	5,0	15,0	13,0	12,2	—	27,5
15/III » »	23,5	4,3	4,3	15,9	14,2	11,5	—	26,5

Note: The burns were inflicted on January 12, 14, 17, and 23.

TABLE 3. Therapeutic Action of Serum from a Horse Convalescing from Burns on Burned Mice and Rabbits

Species of animals	Treatment method	Number of animals	
		total	survived to 5th day after burning
Mice	Administration of serum from horse convalescing from burns	204	86 (42%)
	Administration of normal serum	204	42 (20%)
	Serum not administered	144	16 (11%)
Rabbits	Administration of serum from horse convalescing from burns	263	171 (65%)
	Administration of normal serum	263	85 (32%)
	Serum not administered	28	4 (14%)

Definite interest inheres in the electrophoretic characteristics of the blood serum of the burned horses, which were determined on a Tiselius apparatus*.

As may be seen from Table 2, periodic infliction of burns on horses leads to a change in the protein formula of the blood. Doubling of the γ -globulin fraction and appearance of a spike reminiscent of the T-fraction, which increased after each thermal exposure, were observed 4-6 days after infliction of each burn.

Thirty to forty days after infliction of the last burn, during the period of clinical recovery, this spike merged with the γ -globulin fraction, while the total quantity of γ -globulins increased by more than 40%. During this period the horse sera were tested for therapeutic activity with respect to burned animals of another species. In the control experiments we used serum taken from a horse before it was burned or from a normal horse. The experiments were conducted on white mice and rabbits.

Standard hot-water burns were inflicted on the white mice by the method described above.

In the experiments on rabbits we used males weighing 1.5-1.6 kg. The burns were flame-inflicted, as described above. The doses and times of serum administration were the same as in the experiments in which sera obtained from dogs were employed.

As may be seen from the data presented in Table 3, the sera which we investigated had an advantage over normal sera with respect to their therapeutic action on burned mice and rabbits.

Especially good results were obtained with the rabbits: administration of "antiburn" serum to these animals was accompanied by an improvement in their general condition, which indicates mitigation of the burn autointoxication. While the control animals were sluggish and refused to eat, the experimental animals maintained good appetites and were active.

In our opinion, the data obtained indicate that the serum produced by horses as a result of repeated burns has antitoxic properties which are capable of mitigating burn intoxication in animals of another species.

The material presented is an indirect confirmation of a fact which we previously discovered: that burn antigen has no species specificity. These experiments, undertaken to study the basic feasibility of using serum from horses convalescing from burns for treating burned humans, permit us to hope for a positive solution to this problem.

*The electrophoretic investigations were carried out in conjunction with N. D. Papush in the Protein-Fractionation Laboratory of the Central Institute of Hematology and Blood Transfusion.

LITERATURE CITED

1. D. M. Grozdov, L. N. Pushkar', and V. P. Koshevaya, *Voen.-med. zh.*, No. 11, p. 18 (1955).
2. I. K. Koryakina, S. V. Skurkovich, and N. A. Fedorov, *Pat. fiziol.*, No. 5, p. 56 (1960).
3. N. I. Kuznetsova and S. V. Skurkovich, *Ibid.*, No. 4, p. 57 (1959).
4. S. V. Skurkovich, *Vestn. Khir.*, No. 9, p. 90 (1956).
5. Idem. Abstracts of Papers Presented at the 2nd All-Union Conference of Pathophysiologists [in Russian], Kiyev, p. 350 (1956).
6. S. V. Skurkovich and I. I. Zaretskii, *Khirurgiya*, No. 7, p. 16 (1959).
7. N. A. Fedorov and S. V. Skurkovich, *Ibid.* No. 9, p. 48 (1955).
8. N. A. Fedorov, S. V. Skurkovich, V. B. Freiman, et al., *Pat. fiziol.*, No. 6, p. 53 (1959).

All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.
