

PATHOLOGICAL PHYSIOLOGY AND GENERAL PATHOLOGY

CHANGES IN THE EXCRETORY FUNCTION OF THE LIVER AFTER IMMUNOTHERAPY IN THE ACUTE PERIOD OF BURNS

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Burn trauma causes profound pathological changes in the liver, as shown by histological and morphological investigations [1, 2, 9, 12, 16, 17, 21-23]. Various changes in the functional state of the liver have also been observed: a disturbance of the antitoxic function of the organ [8, 9, 13, 18], and of the pigment metabolism, reflected in the level of the serum bilirubin concentration. In patients with burns covering more than 10% of the body surface the bilirubin concentration in the blood is raised in the first 2-5 days [4, 8, 9, 14]. The proteinogenic function of the liver is also disturbed. In the first few days a decrease in the prothrombin content is found. Burns are often accompanied by hypoproteinemia [11, 19].

Opinions differ regarding the mechanism of liver damage in burns. Some investigators consider that the circulatory disorders caused by the burn trauma lead to hypoxia, giving rise to functional disturbances in the liver [15, 17, 20]. Some authors attribute the leading role to severe endogenous toxemia [16, 21, 22]. Finally, the view has recently gained acceptance that exogenous infection may play a role [8, 14].

The author has demonstrated the role of toxemia in the genesis of the disturbances of kidney function in burns [5, 7]. A distinct parallel has been noticed between the pathological disturbances of kidney function and the toxic properties of the serum from burned animals.

Protection against the toxic substances liberated from the pathological focus is given by the serum of convalescents from burns, which has the property of depressing or neutralizing the toxic products formed after a burn [11]. Immunotherapy, as a method of specific detoxication in burns, was developed originally by N. A. Fedorov and S. V. Skurkovich, and recently it has been applied in clinical practice on an increasing scale.

In the present investigation the effect of immunotherapy, i.e., injection of the serum of a convalescent from burns on the excretory function of the liver was studied in dogs in the acute stage of burns.

EXPERIMENTAL METHOD

The bromsulphalein test was used to diagnose functional insufficiency of the liver, as the most sensitive and accurate of methods at present available. This method is specific, simple in use, reflects the dynamics of the disease well, and is capable of revealing a disturbance of liver function in the earliest stages of burns [6].

Three series of experiments were carried out, each on 6 dogs: series I (control) — on animals with thermal trauma and receiving no treatment; series II — on animals with a burn of similar degree and duration, treated with serum taken from intact dogs; series III — on animals treated with serum from an animal convalescing after a burn.

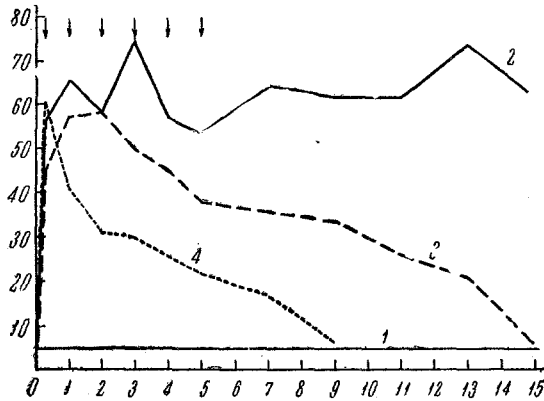
The convalescent serum was obtained from the blood of dogs 1-3 months after a flame burn covering 5-10% of the body surface after an exposure of 1 min. The most active sera with an antitoxin titer of 1:16 and 1:32 were selected for treatment [3].

After the initial data indicating the functional state of the liver had been obtained, the animals of all three series were burned with the flame of a spirit lamp over 15-20% of their body surface for an exposure of 1.5-2 min. Blood samples were taken from all the animals to investigate the excretory function of the liver. The animals of series II and III received an intravenous injection of normal or immune serum 4 h after the burn in a dose of 10-15 ml/kg body weight. The liver function was tested and serum therapy was given daily for 5 days, and subsequent observations were made on alternate days until the liver function had recovered.

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EXPERIMENTAL RESULTS

The results obtained are shown in the figure.



Excretory function of the liver during immunotherapy of burns. Along the axis of ordinates — retention of bromsulphalein in the blood 15 min after injection (in %); along the axis of abscissas — time of observation (in days). 1) Normal; 2) burn; 3) burn + normal serum; 4) burn + immune serum. The arrows indicate injections of serum.

In the experiments of series I a disturbance of the excretory function of the liver was observed in the animals with untreated burn trauma 4 h after infliction of the burn, as shown by marked retention of the bromsulphalein in the blood (56.5% compared with the initial value of 4.6%). On the following days the excretory function of the liver of all the experimental animals remained disturbed. The liver disturbances were periodic in character. The greatest fall in the excretory power of the liver was observed on the 3rd and 13th days after the burn. The retention of bromsulphalein at these times was 74.4 and 75.6%. The normal excretory function of the liver was restored on the 27th day after the burn, expressed by a decrease in the bromsulphalein retention. In one dog the excretory function of the liver did not become normal until 30 days after the burn.

The disturbance of liver function was accompanied by general depression of the animals, refusal to eat, and the development of small granulations with a profuse purulent discharge from the wound.

In the animals treated with convalescent serum the retention of bromsulphalein in the blood during the first day was 40%, compared with 57% in the dogs treated with normal serum (initial retention 4.0-4.5%). The difference between the therapeutic effects of the serum was particularly clear on the subsequent days of observation. Injection of burn convalescent serum led to the more rapid restoration of the excretory function of the liver. The retention of bromsulphalein in the animals of this group reached its initial level on the 7th-9th day, demonstrating restoration of the normal excretory power of the liver.

In the control animals treated with the serum of healthy, intact dogs the excretory function of the liver was restored much later. Retention of the dye in the blood of the animals of this group on the 7th day was 36%, indicating insignificant liver damage. The excretory function of the liver was restored in the control animals on the 13th-15th day after the burn, i.e., one week after its recovery in the dogs treated with burn convalescent serum.

The early restoration of liver function in the experimental animals was accompanied by an improvement in their general condition. The wound surface was cleared of necrotic tissues more rapidly, and covered with healthy pink granulations, whereas in the control dogs at these times the granulations were indolent and pale, and epithelization of the wound took place much later.

The results obtained thus give further evidence of the greater therapeutic action of burn convalescent serum than of normal serum, demonstrated in this case by the liver function after burn trauma.

It may be concluded from the results of these experiments that immunotherapy is directed primarily toward overcoming the burn autointoxication. The author's previous investigations [7] showed that the restoration of normal kidney function in dogs treated with convalescent serum always coincided with marked attenuation or absence of the toxic action of the serum of burned patients on blood cultures, whereas the serum of healthy dogs reduced the toxic action only occasionally. This fact shows conclusively that convalescent serum, by neutralizing the toxic products circulating in the body after a burn, prevents the development of pathological processes in the liver cells.

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