TOXICITY OF THE SERA OF DOGS REVIVED AFTER PROLONGED CLINICAL DEATH

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The toxicity of the serum of dogs surviving after circulatory arrest from electric shock for 12 min and resuscitated by a combined method was investigated in 154 albino mice in which the reticulo-endothelial system was blocked. The serum of the revived dogs showed its greatest toxic action 30 min after resuscitation (73% of the mice died). The second wave of toxemia was observed on the 5th and 9th days after resuscitation. Toxemia in the early period of resuscitation can be regarded as the result of hypoxic disturbance of metabolism. Endotoxemia of bacterial origin also plays a definite role in its pathogenesis.

In the early period of recovery after prolonged clinical death profound functional changes in all the organs and systems are accompanied by disturbance of the detoxication mechanisms of the liver, the reticulo-endothelial system (RES), and so on [1-4, 6].

The RES plays a fundamental role in the neutralization of endogenous toxins of both histogenic and bacterial origin. In recent years considerable attention has been paid to the experimental phenomenon of "blocking" or "saturation" of the RES, which arises after injection of colloidal dyes, special ink, thorotrast, lipid emulsions, and so on [8-10]. Depression of the RES considerably increases the sensitivity of experimental animals to various pathological states (hemorrhagic, traumatic, and burn shock, endotoxemia, radiation sickness, and so on).

The object of the present investigation was to study the toxicity of the sera of dogs resuscitated after prolonged clinical death due to electric shock, using the RES-blocking method.

EXPERIMENTAL METHOD

Experiments were carried out on 154 noninbred albino mice weighing 18-20 g. The sera of 10 dogs in which the circulation had been stopped for 12 min by electric shock, and which had then been resuscitated by simultaneous artificial respiration, indirect cardiac massage, and intra-arterial transfusion of dextran (with the addition of 1 ml 1:1000 adrenalin solution), followed by defibrillation of the heart, were then investigated.

The RES was blocked by injection of ink (Gunther-Wagner) into the caudal vein of the mice by the method of Biozzi and Halpern [7]. The experimental animals received an intraperitoneal injection of 2 ml of serum taken at various times from dogs (restoration of respiration, 30 min, 1, 2, 5, 7, 9, and 30 days after resuscitation) 1 h after blocking of the RES. To determine the effect of heterogeneity of the dog serum, the serum of intact dogs in the same doses as above was injected into 35 control mice with blocked RES. The toxicity of the serum was assessed from the mortality among the mice after 72 h.

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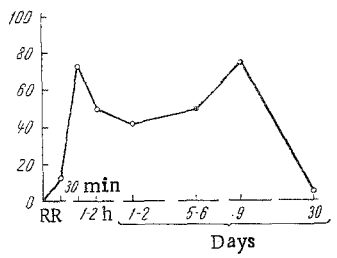

Fig. 1. Toxicity of serum of dogs resuscitated after clinicial death. Abscissa, time when serum was taken after resuscitation; ordinate, mortality (in %). RR – recovery of respiration.

EXPERIMENTAL RESULTS

After electric shock all the animals developed ventricular fibrillation and their circulation stopped. The corneal reflexes disappeared during the first 20-30 sec and respiration ceased 3 ± 0.8 min after the development of ventricular fibrillation. During indirect cardiac massage and other resuscitation procedures the arterial pressure reached 70-100 mm Hg, and only in three dogs was it below 60 mm.

Cardiac activity was restored, as a rule, after a single capacitor discharge 2-4 min after the beginning of resuscitation. Repeated capacitor discharges were given to only 2 animals whose cardiac activity was restored later, namely, after 5 and 7 min.

Respiration usually appeared 2-4 min after the beginning of resuscitation. In five dogs respiration appeared late: after 7 min in four and after 10 min in one dog. Corneal reflexes were restored 12-20 min after the beginning of resuscitation, except in one dog (28 min).

Six dogs subsequently recovered: four quickly, on the 2nd or 3rd day, two not until the 14th day after the experiment; four animals died.

The blood serum taken from the dogs after the experiment and injected into 35 mice with blocked RES proved to be nontoxic. Injection of these sera was well tolerated by all the mice throughout the period of observation and none of the animals died. The sera had the strongest toxic action in the recovery period 30 min after resuscitation. After injection of this serum all the experimental mice showed general depression, twitching of the muscles, acute conjunctivitis, diuresis, and paralysis of the hind limbs. Eleven (73%) of the 15 mice died, in most cases during the first 24 h after injection of the sera (Fig. 1). The toxicity of the serum obtained later, 1-2 h after resuscitation, was reduced. The mortality among the mice at this period was 50%. During the first two days after resuscitation the sera retained their toxic action: 5 of the 11 mice died.

The second wave of toxemia appeared on the 5th-6th day after resuscitation. In this period 7 of the 14 mice died. The toxic effect of the sera was strongest on the 9th day after resuscitation. At this time 6 of the 8 mice died. By the 30th day after resuscitation no toxic properties of the sera could be found (Fig. 1).

The sera of animals surviving after prolonged hypoxia thus exhibited a toxic action. After resuscitation the toxemia in the early recovery period can be presumed to be due, on the one hand, to products of histogenic origin as the result of the hypoxic disturbance of metabolism and poisoning with autolytic products and incompletely oxidized metabolic products, while on the other hand, endotoxemia of bacterial origin may play a definite role in its pathogenesis. A high titer of specific antibodies to the endotoxin of Escherichia coli, discovered by Fedorova and Murasheva [5] in dogs 3-4 weeks after resuscitation, is indirect evidence that in the early period of recovery the body has to contend with infection by this organism. The second wave of toxemia observed in most animals on the 5th-6th and 9th days after resuscitation can be presumed to be due to exogenous bacterial factors and, in particular, to the presence of a bacterial flora in suppurating postoperative wounds. In the recovery period no attempt was made to treat these animals with antibiotics or to use various methods of detoxication.

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