SUCCINATE DEHYDROGENASE ACTIVITY IN THE PARENCHYMATOUS ORGANS OF RATS WITH BURNS OF DIFFERENT INTENSITIES

T. F. Sosnovskaya

UDC 617-001.166-092.9-07:616-008.931:577.158.421

To determine the state of oxidative processes in the parenchymatous organs of burned animals, in the present investigation the succinate dehydrogenase activity was studied in the liver, myocardium, and kidneys after burns.

EXPERIMENTAL METHOD

The experimental animals were albino rats weighing 200-250 g. Three series of experiments were carried out. In series I, a burn of the skin in the dorsal region (12-15% of the body surface) was inflicted on nine animals by exposure for 10 sec to a burning agent at a temperature of 240° (the temperature beneath the skin did not exceed 58°). A burn covering 12-15% of the body surface was inflicted on the nine rats of series II by immersing the hind limbs in hot water as far as the hip joint. The hind limbs, tail, and lower part of the trunk as far as the lumbo-sacral articulation of nine rats in series III were immersed in hot water; the area of the deep burn produced in this way was 30-35% of the body surface. Injury to the skin when this method was used for burning was accompanied by wet necrosis; microscopic investigation disclosed death of the whole thickness of the skin. The rats were killed by decapitation after various periods: 2 h, 24 h, and 5 days after burning.

To determine the relative activity of dehydrogenation processes in the myocardium, liver, and kidneys, the histochemical method of Shelton and Schneider [1]* was used (determination of succinate dehydrogenase). The pH of the phosphate buffer was 7.5. The incubation time of the kidney and myocardium sections was 45 min, and of the liver sections 1.5 h. The distribution of succinate dehydrogenase activity in the healthy animals was indistinguishable from that described previously [2].

EXPERIMENTAL RESULTS

The experiments showed that even after limited burns of the skin, with the development of coagulation necrosis, covering 12-15% of the body surface (series I), the enzymic processes carried out by succinate dehydrogenase fell sharply in intensity. For example, 2 h after burning the largest fall in activity of the enzyme was found in the liver, particularly in the cytoplasm of cells situated close to the central vein. Weakening of the reaction was found also in the kidney; only in the myocardium was the activity of the enzyme changed comparatively little. In the animals sacrificed 24 h after burning, the enzymic reaction showed slight recovery. Five days after burning, the distribution of the enzyme in the myocardium and kidney was almost normal, and weakening of the reaction was found only in the liver.

With burns of the same extent, but with the development of wet necrosis (series II), the succinate dehydrogenase activity was sharply reduced during the first hours. After 24 h the reaction remained at the same level. By the 5th day the increase in enzyme activity was observable only in the myocardium, but as a rule it was by no means near normal.

After a burn covering 30-35% of the body surface with the development of wet necrosis, a still more-marked depression of the histochemical reaction was observed, and was clearly distinguishable 2 h after burning. At the end of the first day no increase had taken place in the activity of the enzyme. By the 5th

*The literature citation section was omitted in the original Russian—Publisher's note.

Department of Thermal Injuries, S. M. Kirov Military Medical Academy, and Department of Pathology, Research Laboratory of Thermal Injuries (Presented by Active Member of the Academy of Medical Sciences of the USSR, I. R. Petrov). Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 64, No. 9, pp. 54-56, September, 1967. Original article submitted January 26, 1966.

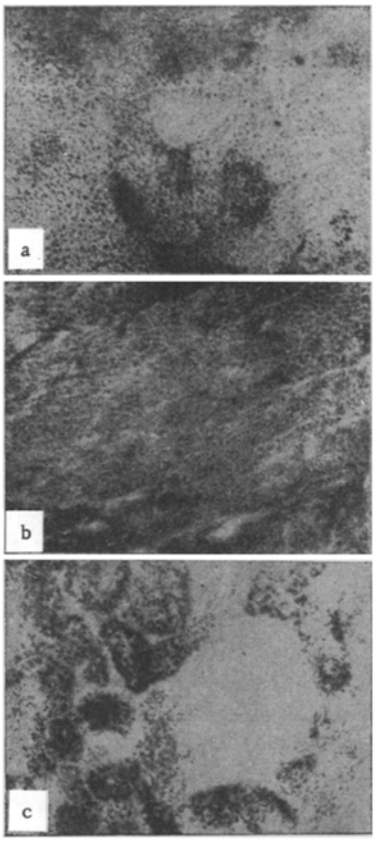

Fig. 1. Decrease in content of the enzyme in the liver (a), myocardium (b), and kidneys (c) five days after onset of wet necrosis of the skin covering an area of 30-35% of the body surface. Objective 10, ocular 7 ×.

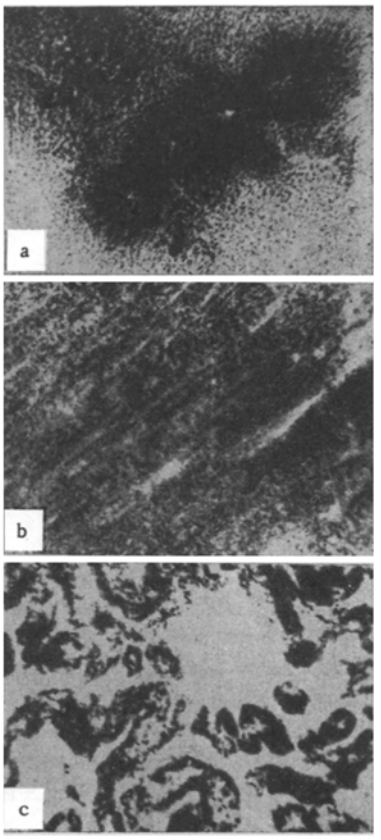

Fig. 2. Content of enzyme in the liver (a), myocardium (b), and kidneys (c) during hormonal treatment with cortisone acetate. Objective 10, ocular 7 ×.

day the reaction in the liver was almost negative (Fig. 1a). In the myocardium, together with a decrease in the intensity of the reaction, the distribution of the enzyme showed some degree of focal concentration (Fig. 1b). In the kidney marked weakening of the reaction was observed in the epithelium of the tubules, especially the distal tubules (Fig. 1c).

In the next experiments early hormonal treatment was given immediately after the onset of wet necrosis of the skin covering 30-35% of the body surface. Some rats (9 animals) received cortisone acetate in a dose of 8 mg/kg body weight immediately after burning, followed by repetition of the same dose daily until the end of the experiment. The remaining nine animals received desoxycorticosterone acetate in a dose of 10 mg/kg immediately after burning, and the same dose thereafter daily until the end of the period of investigation. The rats were killed by decapitation 2 h, 24 h, and 5 days after burning.

Investigation of the succinate dehydrogenase activity 2 h after burning and with administration of cortisone acetate showed that the intensity of the reaction in all the organs was very little diminished; in the heart the activity of the reaction was normal. The level of the enzyme remained the same 24 h after burning. By the fifth day the histochemical reaction in the heart muscle and kidneys was close to normal; weakening of the activity of the enzyme was found only in the liver (Fig. 2). After administration of desoxycorticosterone acetate, the activity of the enzyme in the investigated organs 2 h after burning, just as when cortisone acetate was given, was close to normal. After 24 h, the character and intensity of distribution of the enzyme were hardly diminished. On the fifth day the state of the dehydrogenation processes was close to normal.

Hence, hormone therapy in the acute stage of severe burn trauma led to an increase in the intensity of the enzymic processes, indicating that the pituitary–adrenal cortex system participates in the regulation of intimate enzymic processes in rats.